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SHIP BUILDING IN THE NINETEENTH CENTURY.

ITS PROGRESS AS SHOWN AT THE GLASGOW INTERNATIONAL EXPCSITION—MOST BEAUTIFUL COLLECTION OF SHIP MODELS EVER BROUGHT TOGETHER—FROM THE COMET OF 1812 TO THE TURBINE STEAMER JUST LAUNCHED.

[Special correspondence to the Marine Review.]

Glasgow, Scotland, May 20.—It is not a little interesting to all concerned with shipping that the first merchant steamer to be propelled by steam turbines should be brought into the world just when the progress of ship building during the past century is being illustrated at the Glasgow exhibition. There has just been launched at the yards of Messrs. Wm. Denny & Bros. at Dumbarton, the turbine steamer for the Clyde passenger traffic of which the writer gave some account in a previous communication. She has been built by a syndicate formed by Wm. Parsons, the inventor, and Messrs. Denny, and she is named King Edward. She must be regarded as essentially a new-century creation, although in her lines and general appearance she differs from an ordinary Clyde passenger boat of latest type only in having no projecting sponsons. Her length is 250 ft. between perpendiculars, her breadth moulded 30 ft., and her depth to promendae deck 17 ft. 9 in. This promenade deck extends from stem to transom, and from it companions fore-and-aft lead to the first and second-class saloons, which are lighted by side windows. On the lower deck are the dining saloons and other accommodations. The turbines are three in number and were manufactured by the Parsons Steam Turbine Co. of Wallsend-on-Tyne. The center one is high pressure, and the two outer ones are low pressure. The center shaft has one propeller, and the outer shafts have two each, making five propellers in all, with which it is expected a speed of 20 knots will be easily obtained. A higher speed is not desired in the pleasure service for which the vessel is intended. The performances of the King Edward this season will be watched with the keenest interest, for she is a practical experiment from which great things may be developed.

The builders say they have gone into this experiment after noting the great success of the Parsons turbine machinery in the torpedo destroyers engined by the Parsons Co., well knowing the great advantage to be derived from the fitting of vibrationless machinery in swift passenger steamers. But they admit that there are certain matters yet to be settled with regard to the successful application of turbine engines to merchant steamers. First there is the question of the efficiency of the turbine engine as a consumer of steam. Next there is the question of the relative efficiency of small screws running at a high number of revolutions per minute as compared with large screws running at a lesser number of revolutions. If the King Edward helps to settle these questions satisfactorily then a great future is before the new system. The inventor has no doubt of the result.

The ship building exhibits at the Glasgow International Exhibition for the most part (though not altogether) occupy a large space in the Grand avenue. There may be seen probably the most comprehensive and certainly the most beautiful collection of ship models ever brought together. In the historical section of this department the general design has been to illustrate the progress of ship building, but especially of steam ship building during the nineteenth century. This display is confined to merchant ships alone, and the models are arranged chronologically, so that the progress of development may be followed, not, certainly, year by year, but period by period. The collection is not so completely representative as could be wished, as of several notable pioneers of the century reproductions have not been forthcoming, but in the separate stalls of individual ship builders and shipping companies—to some of which reference may be made another time—specimens may be found to fill the gaps in the historical section.

In order of date this collection begins with the Comet, 1812, and ends with the model of the Parsons (proposed) steel turbine steamer, 1901. The bridging of the gulf between the one and the other marks the development of the steam navigation of the century. The Comet of 1812 was not exactly the first steamer ever built, for this distinction is claimed for a boat called the Charlotte Dundas, into which William Symington fitted a James Wall steam engine and drove her on the Forth of Clyde canal away back in 1801. A model of this remarkable craft, however, is not obtainable, and the model of the Comet only shows the hull. This humble, uncouth looking bit of wood carving, however, represents the maker of history, for the Comet was the first steam vessel in Europe to be practically and successfully employed in regular trading. She was built for Henry Bell (who is accounted the father of steam navigation) by John Wood of Port Glasgow. She was a side-wheeler, of course, and according to the model she had two sets of paddle wheels on each side when built. She was then 42 ft. long, 11 ft. broad and 5½ ft. deep. The engines made for her by John Robertson of Glasgow were single-acting with cylinder of 11 in. and stroke of 16 in., developing 4 H.P. The cylinder was vertical, placed on top of the crank shaft, and the connecting rods moved two levers, which were joined under the cylinder by a shaft and drove the crank through a connecting rod. The crank shaft was geared to the two pairs of paddle wheels, one at front and one at back. The slide-valve was driven from the main shaft through a rocking shaft and the condenser was between the levers. The Comet began plying on the Clyde between Glasgow and Greenock in August, 1812, just eighty-nine years ago. Subsequently she was lengthened to 60 ft., and fitted with a new engine and a single pair of paddles, with which she made 5 knots an hour. A few years later she was taken over to the east coast and plied on the River Forth for a time. Afterward she was brought back to the west and started as the pioneer of the West Highland steam service, running between Glasgow and Fort Williams. She perished on the coast of Argyleshire in 1820, so her life was short though memorable.

Of the immediate successors of the Comet no models are in evidence. At all events none have been procurable for this exhibition. The next steam model in point of date is that of an iron paddle boat the Inverary Castle, built in 1839 by Tod & McGregor (predecessors of the present firm of D. & W. Henderson & Co., builders of the Anchor Line) for the West Highland service. That service was then conducted by David Hutcheson, a nephew of G. & J. Burns, who along with Samuel Cunard, Robert Napier of Glasgow and D. M. McIver of Liverpool, founded the Cunard Line. This Inverary Castle was a 230-ton boat fitted with steeple engines, jet condensing, with one cylinder of 50 in. diameter and 4 ft. stroke. She was still in active service with David MacBrayne (who succeeded to David Hutcheson) until a few years ago. She was not, however, the first iron steamer, though of the same year as the Royal Sovereign, built by the same builders for the service between Glasgow and Liverpool.

Very interesting are the models—of the good old sailer type—of the Peru and Chile, built by Curling, Young & Co. of London in 1839 for the Pacific Steam Navigation Co.'s trade between Panama and Valparaiso. These pioneers of steam navigation in the Pacific measured only 198 ft. in length and 50 ft. in extreme breadth, and they had direct-acting engines of only 50 H.P. But they served their own generation well and they "made history." It is an education in itself to step from these models out of the historical section into the stall of the Pacific Steam Navigation Co. nearby, and there to inspect the beautiful models of their splendid twin screws Columbia and Ortona, built just sixty years later. One needs such a practical contrast now and then to teach us what we have been, and what we are, and to suggest something of what we may be.

Another example in the historical section is a pretty little model of the first Cunarder, the Britannia, a wooden side-wheeler of 620 tons register, 207 ft. by 34 ft. by 24 ft. 8 in., built by Duncan of Port Glasgow and engined by Robert Napier of Glasgow (founder of the establishment now owned by Wm. Beardmore & Co.) with side-lever jet-condensing engines of 413 I.H.P., cylinders 72½ in., stroke 6 ft. 10 in., four flue boilers. She was the first of the four sister boats with which the Cunard company began business, and she sailed from Liverpool in July, 1840, for Halifax and Boston. On that historic voyage, of which so much has been written, she consumed 440 tons of coal on the outward and 450 tons on the homeward run. But she was frozen up in Boston harbor and the Bostonians kindly cut a passage for her seven miles long through the ice to open water. From her to the Lucania is but a step on the floor of the show, but what a space in development! The model of the Lucania is large and beautiful, and it is of the deepest interest to compare her lines and dimensions—12,950 tons gross, 21,920 tons displacement, 622½ ft. length, 65 ft. breadth, 43 ft. depth, engines of 30,000 H.P., huge cylinders, and twelve big boilers—with the humble Britannia. Then as to speed, the latest Cunarder's record, 22 knots, to the pioneer's 8½ knots. In point of size, of course, the Lucania is exceeded by the Cunard Saxonia (also shown) of 14,000 tons, though not in speed, and she again by the White Star Celtic, which, however is not included in the historical section.

This section (some of whose deeply interesting details may be referred to again) closes with a model of the new Anchor liner Numidia, lately described, and with one of the proposed turbine steamers before mentioned—275 ft. long, 32 ft. broad, 13 ft. deep, to be propelled by Parsons compound turbines, with multiple screw propellers and 20,000 I.H.P. at a speed of 30 knots. Rather a long jump from the poor old Comet.

NAVAL ARCHITECTS AND MARINE ENGINEERS.

Naval Constructor W. L. Capps, secretary of the Society of Naval Architects and Marine Engineers, is already making necessary preparations for the ninth annual meeting in New York in November next. In a letter to members of the society, Secretary Capps says:

"The executive committee of the council invites correspondence concerning papers to be read at the ninth annual meeting in November next. It is quite important that papers should be in print thirty days before the meeting so that they can be distributed in advance. Members who desire to submit papers or who have suggestions to make are requested to communicate with the secretary at their earliest convenience. A member of the council has offered a prize of $100 for the best paper upon the subject of 'The Theoretical and Practical Methods for Balancing Marine Engines.' Papers submitted in competition for this prize must be sent to the secretary before Oct. 1, and should be plainly addressed and marked in one corner 'For Prize Competition,' and underneath the motto or other distinguishing title of the sender. In a sealed envelope similarly addressed, should be enclosed the name of the sender and his motto or distinguishing title. Further information on the subject of papers to be read at the meeting will be furnished on application to the secretary."

President Clement A. Griscom informs the members of a resolution adopted a short time ago when Rear Admiral Bowles resigned the office of secretary and was succeeded by Naval Constructor Capps. The resolution is as follows:

"The secretary and treasurer of this society having tendered his resignation because of duties at Washington incident to his advancement to the rank of chief constructor of the navy, and said resignation having been accepted,

"Resolved, That the council hereby places on record this acknowledgment of its many obligations to Rear Admiral Bowles for his able and efficient services to this society as chairman of the executive committee of the council from the date of the society's organization and as its secretary and treasurer during the past five years; and the council desires especially to note its satisfaction that this merited promotion assures the continuance of the highest standard in the design, building and equipment of our ships of war."

A LAKE ENGINEER ON THE BOILER QUESTION.

Editor Marine Review:—The use of Scotch boilers in a large number of new steamers, built during the past winter in our lake ship yards, has been taken by most of our engineers and vessel owners as an indication that the Scotch boiler is a winner in the fight for supremacy with the so-called water tube generator. To the progressive engineer this view brings a feeling of disappointment. He feels that it has been brought about through lack of knowledge of the merits of the water tube boiler and its superiority as an economical steamer. Our modern lake engineer not only wishes to be progressive but has a desire to be a leader in the science of steam engineering. This desire has brought about the invention and adoption of improvements in the construction and management of the lake water tube boiler, to the extent that today the lake engineer leads the world in the matter of handling economically the water tube type of boiler. The serious difficulties met and overcome by engineers in charge of these boilers may be summed up as follows:

First we had the plugging up of the inside of the tubes with mud and scale from lack of time in port to properly clean and remove these deposits of carbonates of lime, magnesia and iron, and sulphates of lime. As all sulphate of lime in water is deposited or precipitated at a temperature of 300° Fah., the introduction of the feed water into and through a feed water heater and precipitator before entering the boiler has removed this first and great difficulty. By blowing out our heaters and precipitators twice a watch we are now able to run our water tube boilers continuously for six and eight weeks, and then find so little deposit that they can be cleaned thoroughly in eight hours. This was the actual practice on many steamers last year, without one minute delay to the ship and not one cent for repairs to boiler tubes or furnaces at the end of the season.

As a second difficulty it may be noted that the evaporative efficiency of the water tube boiler decreases rapidly in a few hours from the loss of heating surface in many of its tubes. These tubes, placed close together, are soon coated with a heavy deposit of soot. The spaces become closed entirely to the passage of the hot furnace gases. Upon forcing the fires the soot becomes ignited (resulting sometimes in a red hot breeching, up-take and smokestack), leaving an accumulation of solid ash and clinker between the tubes, which, increased from time to time by more soot and more burning, impedes the circulation of heat around the tubes, with a noticeable loss of heating surface. Where a forced draft, under the grates, into a closed ash-pit, has been adopted, keeping a steady air pressure of about ⅝ in. regardless of wind or weather, much better results have been obtained and less sooty deposit found than when running under natural draft. By means of steam flue-blowers inserted in holes with loose covers, and also through large cleaning doors, aided by powerful steam jets in the smokestack, much of the sooty matter is blown off and carried up overboard. Where this is done once in every twenty-four hours, nearly all of the lost heating surface is cleaned and regained.

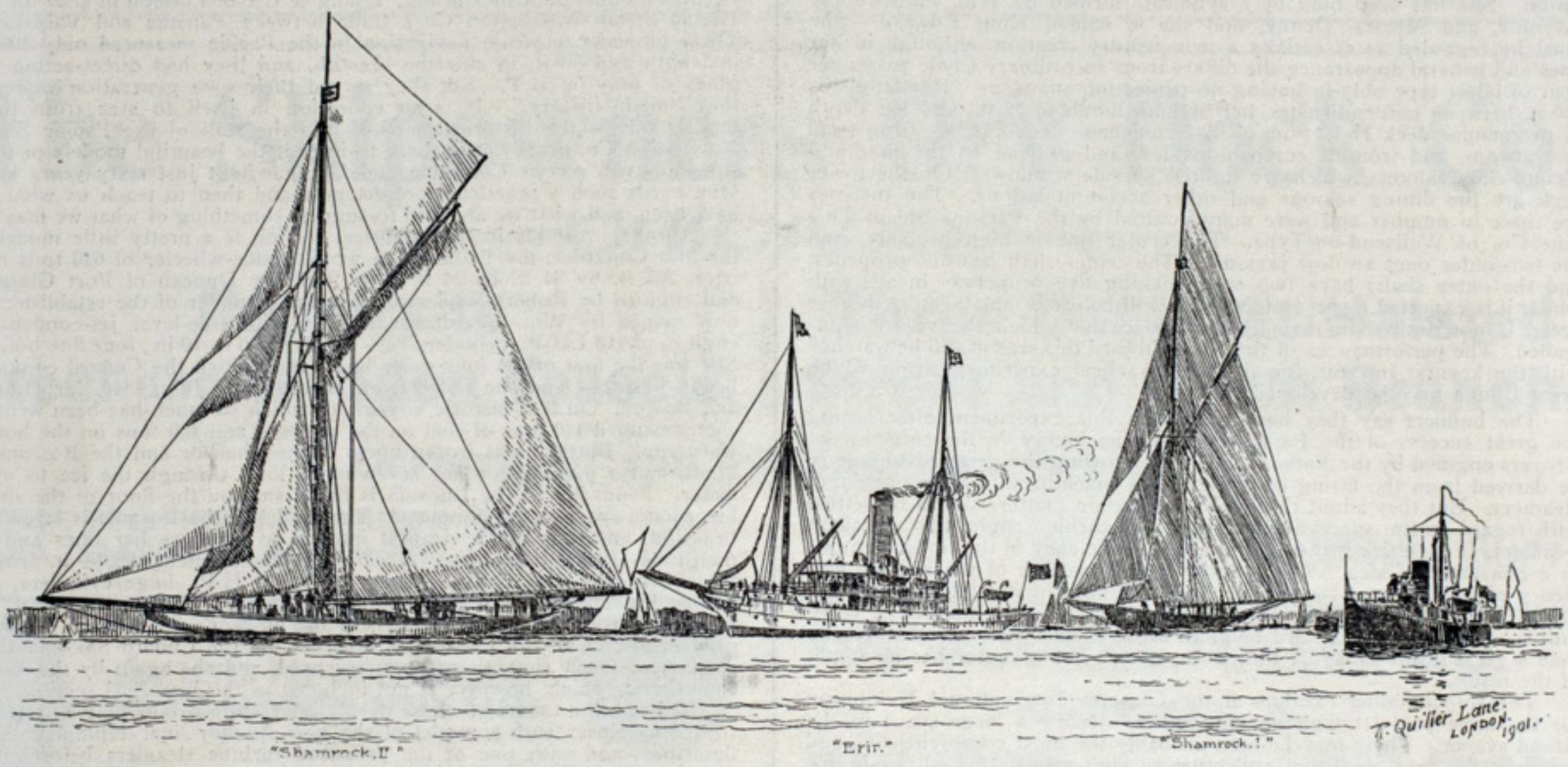
As nearly all the difficulties and losses enumerated under this second heading can be traced directly to the one condition—a state of imperfect combustion in our furnaces—and as the remedy to be applied is that of creating a state of perfect and complete combustion, the lake engineer has succeeded by the introduction of the automatic stoker in removing most if not all of the troubles under this head. It is well known that without perfect combustion a great portion of the heat which the fuel is capable of yielding is not developed and hence loss results, and it is also known that smoke and soot are sure evidences of imperfect combustion. Still we must remember that it does not necessarily follow that where there is no smoke there is perfect combustion. The automatic stoker produces a smokeless combustion, but that it also produces a state of perfect combustion is still an open question. However, the automatic stoker is here to stay beyond all question, and there is every evidence that it will be greatly improved. Already we have the truly wonderful sight of our 7,000-ton ships, equipped with water tube boilers and automatic stokers, making the trip from a Lake Erie port to the head of Lake Superior and return, a distance of about 1,800 miles, upon a fuel consumption of 225 tons of slack coal. When we remember that 225 tons of the best lump coal was used in making the same trip by the most economical 2,000-ton steamer of ten years ago, the progress is certainly to be wondered at.

The third difficulty has been that of tending water. The small quantity of water carried and the rapid evaporation of the same necessitated the constant attention, night and day, of a man to tend water. For this labor the engineer had nothing to show at the end of the trip, to say nothing of disastrous results that would follow slight inattention on the part of the water tender. The invention and adoption of the feed water controller and pump governor brought about a surprising change. Steamers equipped with this device run from one end of the trip to the other without ½ in. variation of water line in the boilers, regardless of checks, stops or cleaning fires. Engineers exhaust their vocabulary in its praise, while still only beginning to appreciate the advantages of a steady water line. For the first time in the history of steam engineering we have an automatic water tender, self-cleaning and under perfect control, thoroughly reliable and producing good results along the line of economy.

The fourth and last, although not the least, difficulty has been the handling of the high steam pressures. The sudden jump from 150 to 250 and 270 lbs. has found us unprepared, and only by experience and hard knocks have we been able to meet the situation. New methods have been forced upon us, ofttimes resulting in entire failure, and where old methods have been applied to the new conditions, disheartening effects have mocked our best efforts. During this severe apprenticeship we have asked for no sympathy but have kept our nerve and "tried, tried again." until now we see success crowning our earnest desires.

In conclusion, it is probably in order to say that while we notice with much pleasure the satisfactory results obtained from the propelling machinery of such steamers as the Black, Murphy and Shaw, still they prove nothing one way or the other, and until two steamers exactly alike in model and machinery, differing only in the type of boiler, have been run under the same management for several seasons will we be ready to admit "who is the winner." May the best man win, is the wish of

Cleveland, May 28, 1901. YE MARINE ENGINEER.



BOTH SHAMROCKS AND SIR THOMAS LIPTON'S STEAM YACHT ERIN OFF THE BRAMBLES BEFORE THE START OF ONE OF THE TRIAL RACES, WHICH PROVED DISASTROUS.

NEWPORT NEWS DRY DOCK.

Newport News, Va., May 29.—The three ships which first entered the immense new dry dock at the ship yard here—the Plant liners Olivette and Miami, and the Chesapeake & Ohio steamer Louise—have been repaired and have given place to the Chesapeake & Ohio steamer Accomac, which has gone in to have her bottom painted. There were no formal ceremonies in connection with the opening of the dock, these exercises being reserved for an occasion of more importance. It is said that the battleship Illinois and another battleship, if one is available, will be used on the occasion, in order to demonstrate the capacity of the new basin, which is capable of receiving the largest vessel afloat or building, and which can accommodate two first-class battleships; or, as was the case on the opening, accommodate three vessels of moderate proportions. The new dock is 800 ft. long and has a depth over sills at mean low water of 30 ft. The three steamers first docked in the basin presented a peculiar appearance, the upper deck of the largest one coming hardly above the top of the dock.

The North German Lloyd steamship Main occupies the old 600-ft. dry dock to the south of the new basin and will probably be there sixty days longer. This immense hull looms way up above the top of the dock and fills it almost completely. All around the bottom of the keel and up around the sides staging has been erected and it looks as if the old vessel will be practically new when she leaves the yard. All of her injured plates are being replaced with new ones, and a glance at the work now being done is sufficient to show even a tyro in ship building affairs that the price of $700,000 was not too great for the repair job.

BUFFALO SHIPPING MATTERS.

Buffalo, May 29.—A matter of 200,000 bushels of wet grain in the first Lake Michigan cargoes before they were all accounted for is not very much, maybe, in an aggregate of a dozen millions, but, considering that so much of it was the result of carelessness it is a trifle too bad all around. The insurance people are pretty good natured and they paid for most of the lots that were of much size, but they could not swallow the entire dose, so the vessel owner has occasionally had to put his hand into his pocket for the loss. It used to be practically all on account of wooden vessels. Now it is all sorts of things, internal difficulties playing a large part.

The elevators did their work well, but they came very close to the end of the railroad capacity for all that. An elevator blockade is, of course, nothing but a giving out of cars, for practically all the grain taken here is for transfer only. They do say that the New York Central came very close to the end of its capacity and there are those who are imagining that a stoppage or two on account of "deranged machinery" may possibly be as much due to lack of cars as anything else. It is the insufficient carrying capacity of the roads that is making it possible for the poor boatman to earn something. For the sake of canal sentiment it is to be hoped that there will be some profits in the business once more. There has been next to none since 1893, when the roads kept their hands out of the rate-cutting business and everybody lived.

Package freight appears to be getting the worst end of it just now. The road combines, if they were made in order to prevent rate wars, have signally failed. A line manager says that he supposes there will now be a fixing up of rates again till the low-rate stuff has all been used up and then there will be another cut. This is a western accomplishment to a great extent. If the roads want to take stuff low from Buffalo eastward they quite generally make an open tariff or a uniform inside one and leave off the fighting, but the western road is captured usually in the Minneapolis flour country, so that there can be something to cut down. Then the lakes follow and the flour man the other side of Lake Michigan gets such a benefit that the poor Buffalo miller wishes that he had a thousand-mile haul instead of less than half of it, so that he would be regarded as worth looking after.

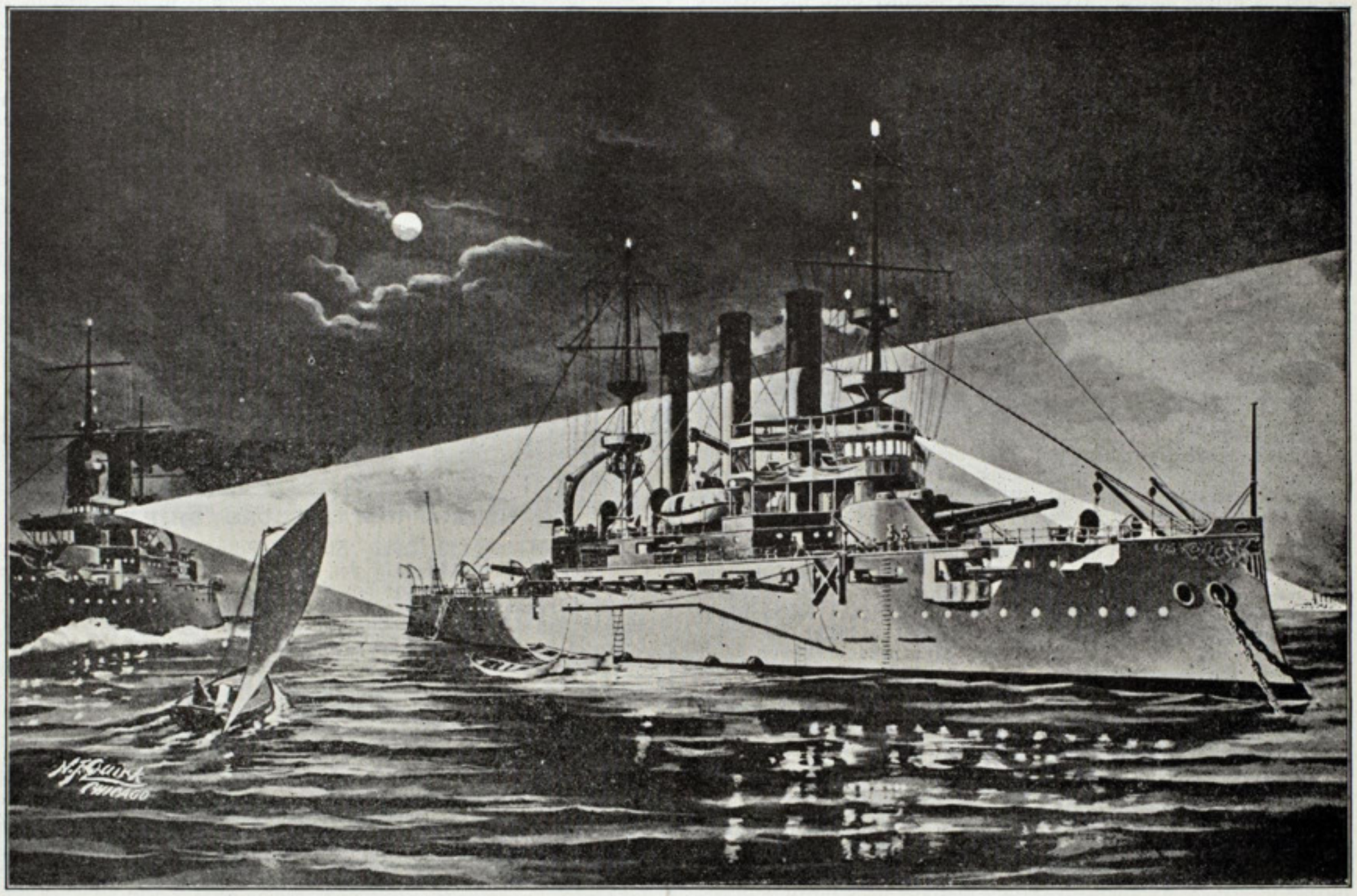
We are finding that Pittsburg is not blind to the Buffalo ore-smelting conditions, for word comes from there that coal is not all there is in the calculation, but that when the coal all runs out the 10,000,000-horse-power energy of Niagara will be good for the whole demand. The home lay mind is a trifle anxious to learn how the new Buffalo steel plant will line up with the others to the west and southwest of us, but there is no way of crowding the steel plant forward to completion any faster than the present forces can do the work laid out. When it was said at the start that it would be two years before any ore reduction could be done it was looked on as a very long interval, but now there are two months more than that time gone and the canal that is to open the route to the furnaces is not dug. Still the work goes on with a good amount of energy and there will be results in time.

I have been accused of being too severe on the members of the city council who opposed the original dredging plan, because it was argued that everything asked for has been secured by a better plan, but I find that the marine men, and well-posted ones among them, are not satisfied yet. Some of them say that the council hurt this port more than it can ever make good, for business diverted to all-rail does not come back at all readily. Meanwhile the dredge has not been ordered to the work yet, whatever has been done, and the east wind blows every day. There was never such a season for it and may there never be another. This port does not feel the force of an east gale, for some reason, but it suffers from low water. We shall begin to envy Toledo after awhile if this sort of thing goes on.

JOHN CHAMBERLIN.

LAUNCH OF BATTLESHIP MAINE.

The battleship Maine, building at Cramps, Philadelphia, is to be launched on Memorial day. It was at first intended to launch the battleship upon the anniversary of the destruction of her namesake, Feb. 15, but it was found impossible to do so. The Maine, Missouri and Ohio are sister ships. The Ohio was launched two weeks ago, and as the class was fully described at the time it will only be necessary to enumerate the salient points of the Maine. The general features and dimensions are: Speed, 18 knots; length, load water line, 388 ft.; breadth, extreme, 72 ft. 2½ in.; mean draught, 23 ft. 6 in.; displacement, 12,440 tons. Main battery: Four 12-in. breech loading rifles; sixteen 6-in. rapid-fire guns. Secondary: Six 3-in. rapid-fire guns, eight 6-pounder rapid-fire guns, six 1-pounder rapid-fire guns, two 3-pounder rapid-fire field guns, two colts. Armor: Water line belt, top, 11 in.; water line belt, bottom, 7½ in.; degree above main belt, 6 in.; superstructure armor, 6 in.



A PAINTING OF THE BATTLESHIP MAINE BY NICHOLAS J. QUIRK OF CHICAGO. THE MAINE, MISSOURI AND OHIO ARE SISTER SHIPS.

Roach's Ship Yard, Chester, Pa., will build three steel barges for the Panama Railroad Co. Orders have been placed for the material for the vessels. The boats will be what are known as "knock-downs," the material being all punched and the plates fitted to the frames, ready for riveting. No rivets will be driven on the shell plating, although the frames will be riveted together. After the material has all been made ready, each piece is numbered and taken down and shipped to Central America, where it will be erected in place by mechanics and the boats launched ready for service. The three barges will be something over 100 ft. in length and about 20 ft. beam. They will be used for lightering freight from ships in the shallow harbors in Central America.

The naval board having charge of the location of a naval station at Pearl harbor, Hawaii, has completed its work. The board adheres to the view that Pearl island is the only harbor in the Hawaiian group capable of complete naval defense. It is only five miles from Honolulu. The improvement of the harbor contemplates a deep-water channel across the coral bar at the entrance and heavy batteries on each side of the entrance.

Consul-General Smith reports from Monrovia that the Liberian government has granted to the Afro-American Steamship & Mining Co. of Boston the right to establish a steamship line between Boston and Liberia; to build wharves, quays, railways and tramways, and to carry on a system of mining operations for a period of fifty years. The Liberian government receives in consideration thereof $10,000.

WRECK OF THE BALTIMORE.

Hurried telegraphic stories of the wreck of the steamer Baltimore on Lake Huron on Friday last, which resulted in the loss of Capt. M. H. Place of Cleveland, his wife and all the crew excepting an assistant engineer and one of the sailors, did not give an account of circumstances leading up to the disaster from which the cause of the loss of the ship, aside from the heavy weather she encountered, might be determined. This is contained in a statement signed by the two survivors, Assistant Engineer Thomas Murphy and Sailor Frank McGinnis, upon reaching Cleveland a few days after their unfortunate experience. The tale about one of these men having lost his mind after the wreck was entirely without foundation. He was unconscious from exposure but recovered very soon after the rescue. The statement made by these two men is as follows:

"Both of the signers of this document shipped on the Baltimore on her first trip this spring and stayed with her until her loss. The ship left Lorain on her first trip of the season in thoroughly sound and seaworthy condition and continued in such condition up to the time that she was lost as herein stated. We had good weather until the evening of the 23rd. Then it began to blow from about northeast and the wind and sea increased in force until between 9:30 and 10 o'clock that night, by which time there was a terrific northeasterly gale blowing with heavy rain and seas. By 11:30 o'clock the seas were dashing over the upper deck and breaking in some of the after cabin doors, and about 1 o'clock the next morning, when the vessel was perhaps an hour's run above Thunder Bay island light, the seas were breaking in the cabin doors and were running so terrifically high that it was deemed unsafe to run into the storm any longer. The captain therefore turned about at this point for the purpose of running back to Tawas for shelter. The ship came round all right, although the seas were mountain high, and she continued to make good weather down the lake until she reached a point abreast of Point au Sable, or Dread Sable, as it is called, and from two and one-half to three miles off shore, where she struck the bottom heavily and fetched up. During the run from Thunder Bay island to this point the pumps were sounded as usual and Thomas Murphy, one of the signers of this protest, being in watch, examined the water and the crank pit every half hour as usual and the vessel was not found to be leaking at any time. This storm was said by the life-saving crew and fishermen about Tawas to be the most severe storm that has occurred on Lake Huron in five years. The stranding occurred at 5:50 a. m., May 24, and the vessel stayed where she struck until she went to pieces. She raised and dropped so heavily after she had stranded that her rudder stock was driven up through her stern, causing the frame work of the engine to lift. The engine was backed strong from the instant she struck until her main steam pipe cracked and began to leak steam. Then it was necessary to shut off steam to prevent scalding the engineers. And as it was then apparent that the vessel would very speedily pound to pieces if she continued to pound the bottom, the master ordered her scuttled. The seacock was thereupon opened in the crankpit and the hatch covers removed, allowing the vessel to fill and settle on the bottom. She labored and pounded on the bottom for about two hours after this when she began to go to pieces, and finally broke in two. Her rails broke on both sides just aft of the forward house and as she began to split in two, we could see that many of her beams had started and pulled loose so that she was also breaking in two athwartships. At this time Capt. Place directed us to save ourselves as best we could. Every effort was made to lower both of the ship's life boats, but the seas broke over so heavily that they could not be launched and holes were stove in each of them by articles floating about the deck and by their striking against the bulwark. The big boat finally floated over the rail, and Capt. Place, his wife and the chief engineer got into it, but it filled and went down almost before it had left the ship's sides. We afterwards saw Capt. Place and the chief engineer floating on different pieces of wreckage, but did not see anything further of Mrs. Place, and it is certain that she went down with the big life boat. Fifteen or twenty minutes after this we saw Capt. Place for the last time hanging to some wreckage, and the chief engineer hung on for a few minutes longer. We succeeded in getting on to a piece of the promenade deck, on which we drifted to a point abreast of Tawas, where we were picked up by the Columbia about 2:30 p. m., and taken into East Tawas. When we left the vessel she had practically broken all to pieces. Deponent Murphy went out to her on May 27, and so far as could be seen, there was nothing left of the vessel except her steering pole, her fore-mast, which had broken, but was caught on something, and her cylinders, the tops of which stood up above the water a little. From the morning of the wreck until noon of May 27, Deponent Murphy and others patrolled the beach and found it strewn with great quantities of wreckage from the vessel for a distance of eighteen miles south of Tawas; but the only body found up to that time was that of the wheelman, William Sears. The sole cause of the loss of the Baltimore was her stranding in the manner above stated, and she was in good seaworthy condition until she fetched up as above stated."

Capt. Andrew Hackett, whose father was keeper of the light on Bois Blanc island near the mouth of the Detroit river, and who has himself been in charge of the light for thirty-five years, is so seriously ill that all hope of his recovery has been given up. Duties in connection with lights and buoys in the river near Amherstburg made Capt. Hackett known to almost every vessel master of the lakes. He was highly respected.

J. C. Gilchrist of Cleveland, who has a fleet of fifty odd steel and wooden vessels on the great lakes, has just purchased two more, the A. A. Parker and B. W. Parker, wooden vessels that have been owned for a long time past by A. A. & B. W. Parker of Detroit.

Invitations have just been issued by the board of trustees of Webb's Academy and Home for Ship Builders for the fifth annual commencement, which takes place at the institution, Fordham Heights, New York city, on Thursday afternoon, June 6, at 3 o'clock.

STEEL CORPORATION STOCK.

It was not until Thursday last that the governing committee of the New York stock exchange added to the list the additional stock issued by the United States Steel Corporation on account of the purchase, some time ago, of the American Bridge Co. and the Lake Superior Consolidated Iron Mines. The addition is $83,486,300 of preferred and $81,473,400 of common stock, making the total of preferred listed to date $508,486,300 and of common $506,473,400. It was announced that more than 98 per cent. of the common stock of the Bridge Company and more than 99 per cent of the stock of the Consolidated Mines had been deposited in exchange for steel stock, and that the United States Steel Corporation had also purchased the one-sixth interest owned by the Oliver & Snyder Steel Co. in the Oliver Iron Mining Co. and the Pittsburg Steamship Co.; the remaining five-sixths interests in those companies being already owned by the United States Steel Corporation through its ownership of the Carnegie Co.

In reference to the American Bridge Co. the statement accompanying the application to list reads: "The company began business about the latter part of May, 1900, and has not yet completed its first fiscal year, so that no complete balance sheet is yet available. The company has issued no bonds and there are no underlying mortgages upon any of its plants, with the exception of about $100,000, which is to be retired by the issue of stock already made. It has been impracticable to yet accomplish the actual retirement of this amount owing to the fact that the mortgage has not matured. The company has acquired plants either directly or by ownership of stocks."

The following statement is made regarding the Lake Superior mines: "The company has issued no bonds and has no indebtedness except current accounts against which it has quick assets of an equal amount. It owns the entire capital stock of the Duluth, Mesabi & Northern Railway, which extends from Duluth into the Mesabi range, having a main line of about 120 miles in length, with second track, sidings, etc., aggregating about 100 miles more. Its outstanding bonds aggregate $7,765,000, of which $2,305,000 are owned by the Lake Superior Consolidated Iron Mines. The company also owns in fee or in lease, in known and practically explored mines, between 300,000,000 and 400,000,000 tons of iron ore in the Mesabi region. It also has other large mining interests. The Pittsburg Steamship Co., of whose capital stock five-sixths is now owned by the Carnegie Co., and the remaining one-sixth by the United States Steel Corporation, has acquired for cash the vessels belonging to the Bessemer Steamship Co., consisting of about fifty-seven steam vessels plying in the ore trade on the lakes."

The remainder of the authorized capital stock of the steel corporation, consisting of $41,513,700 in preferred and $43,526,600 in common will remain in the treasury of the corporation subject to the order of the directors.

NOTES FROM THE COAST SHIP YARDS.

The William R. Trigg Ship Building Co., Richmond, Va., will increase its capital stock 50 per cent., its acreage 200 per cent., and will add three members to the board of directors. The capital stock will be increased from $2,000,000 to $3,000,000, of which $1,000,000 is to be in preferred and $2,000,000 in common stock. The new directors are to be George W. Stevens of Richmond, Va.; C. Stewart Patterson of Philadelphia, and William S. Ellis of Philadelphia. The land added to the present area of twenty-five acres embraces seventy-five acres within the city limits and 500 acres beyond the city limits.

The Portland Ship Building Co., South Portland, Me., launched the steamer Henry F. Eaton a few days ago. The Eaton was constructed for the Frontier Steamship Co. and will be run between Eastport and Calais, a distance of thirty miles. She is a single screw steamer, 120 ft. over all, 26 ft. beam and 8 ft. deep. She is of about 200 tons burden and is expected to make fifteen miles an hour.

Z. M. Fickett of New York has contracted with J. W. Gulder for a three-masted schooner of about 400 tons capacity and intended for general freighting trade. The dimensions will be: Length over all, 125 ft.; length on keel, 115 ft.; breadth of beam, 28 ft. 6 in.; depth of hold, 9 ft. She will be built of white and live oak, planked with yellow pine. She will be built at or near Tampa, Fla.

The Ottawa Electric Railway Co., Ottawa, Can., is contemplating placing a steamboat on Lake Deschenes and the upper Ottawa to care for their passenger traffic. The vessel will be large enough to accommodate several hundred passengers and will be similar to the type employed on the Mississippi river.

The New England Ship Building Co., Bath, Me., has closed a contract for building a wooden four-master for A. J. Huston of Baltimore. The dimensions of the vessel are: Length, 156 ft.; beam, 38 ft.; depth, 13 ft.

A four-masted wooden schooner, the Ada F. Brown, was launched from Charles V. Minott's yard at Phippsburg last week. She is 221 ft. long, 11.5 ft. beam and 18.6 ft. deep.

The Holland Submarine Torpedo Boat Co. has opened an office in Elizabethport, N. J., and will remove part of their equipment and office force from New York.

A. D. Story, Essex, Mass., is building two wooden schooners for D. B. Smith & Co. which will be launched in June.

One of Nicholas J. Quirk's pictures of naval vessels is reproduced in this issue of the Review. Mr. Quirk is a Chicago artist whose work has been commended by Rear Admiral Hichborn, Chas. H. Cramp and other naval authorities. One of his pictures of the battleship Ohio was used on the official invitation to the launch of that vessel at the Union Iron works, San Francisco, which was attended by the president.

Decoration day rates via the Nickel Plate road at a fare and a third round trip, good within a distance of 150 miles only. Tickets on sale May 29 and 30, good returning the 31st inclusive. Write, wire, 'phone or call on nearest agent, E. A. Akers, C. P. & T. A., Cleveland, O. 75, June 1

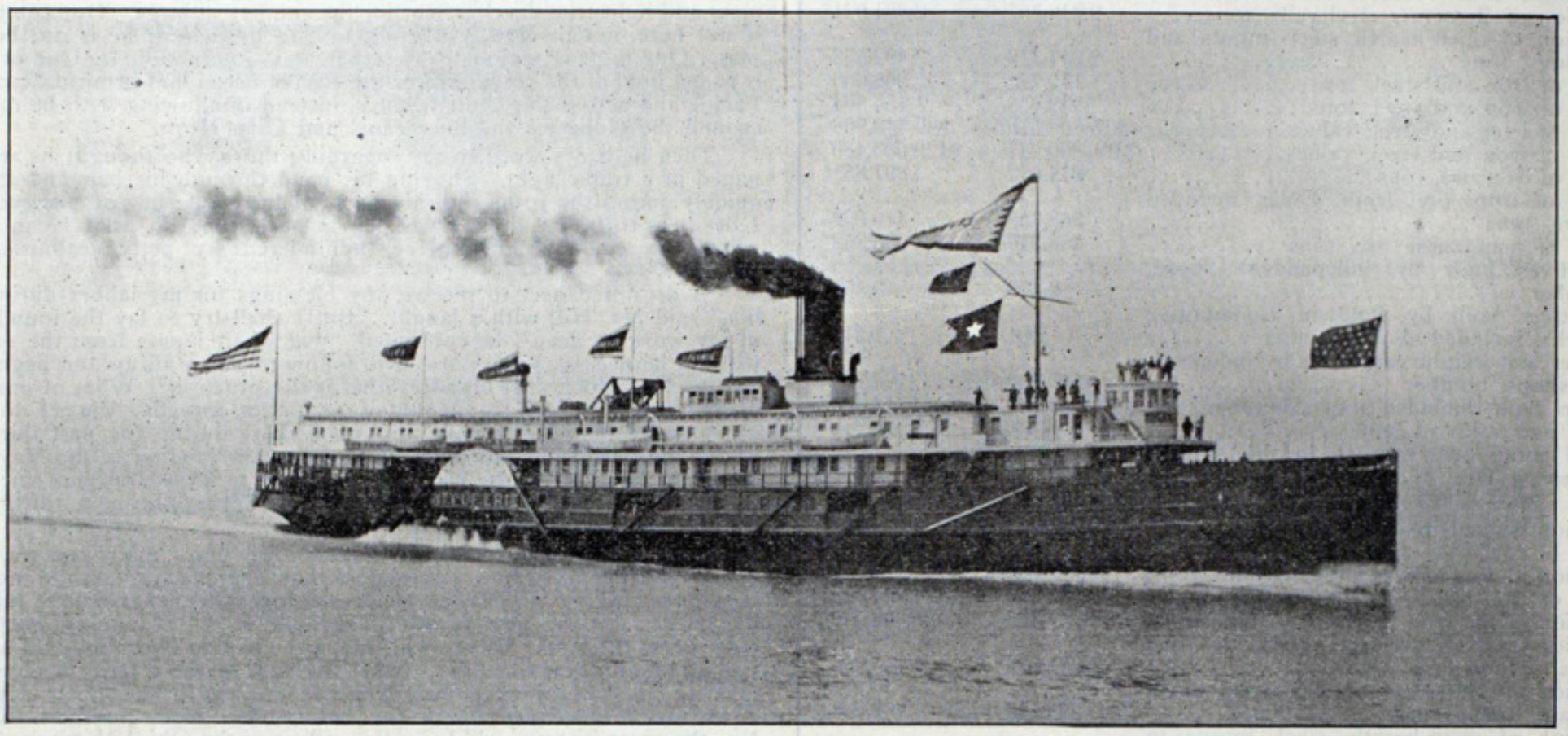
THE RACE BETWEEN THE CITY OF ERIE AND TASHMOO.

The daily newspapers have pretty thoroughly acquainted the country with the fact that the City of Erie of the Cleveland & Buffalo Transit Co.'s line and the Detroit steamer Tashmoo of the White Star line are to race on Tuesday, June 4. It is to be, however, more of a contest of speed than a race and will have the effect of getting both boats into thorough shape for the season's work. Should the lake be rough there will, of course, be no contest, as the Tashmoo is exclusively a river boat and is designed for the smooth water of the Detroit and St. Clair rivers, between Detroit and Port Huron. Should the lake be unruffled something of value may come out of the brush. Both vessels are practically of equal length, the Tashmoo being 322 ft. over all and the City of Erie 324 ft. over all. The distinguishing difference is in beam and displacement. The Tashmoo, intended for fast excursion service, may be likened to the Hudson river style of side-wheelers, while the Erie, fitted with a great number of state rooms for an all-night run in open lake between Erie and Buffalo, and for carrying a large amount of deck freight, is of broader beam and is the kind of side-wheeler that is suited to heavy weather. The Erie's beam over hull is 43 ft. and over guards 78 ft.; the Tashmoo's beam over hull is 37 ft. and over guards 71 ft.; the Erie's displacement is 2,000 tons and the Tashmoo's 1,200 tons. To offset this difference the Erie is equipped with engines said to be capable of 6,000 H.P., as against 2,800 H.P. for the Tashmoo. A further difference exists in the fact that the Tashmoo is equipped with inclined triple expansion engines, while the Erie has the familiar walking-beam variety. The Erie, it will be noted, has more than twice the Tashmoo's engine power, with considerably less than once again her displacement. Whether this extra horse power will be able to overcome the advantage which the Tashmoo possesses in a hull of finer lines, is the point to be determined. Frank E. Kirby, long with the Detroit Dry Dock Co. and still consulting engineer with the Detroit Ship Building Co. (name adopted after the works were acquired by the American Ship Building Co.), designed both vessels.

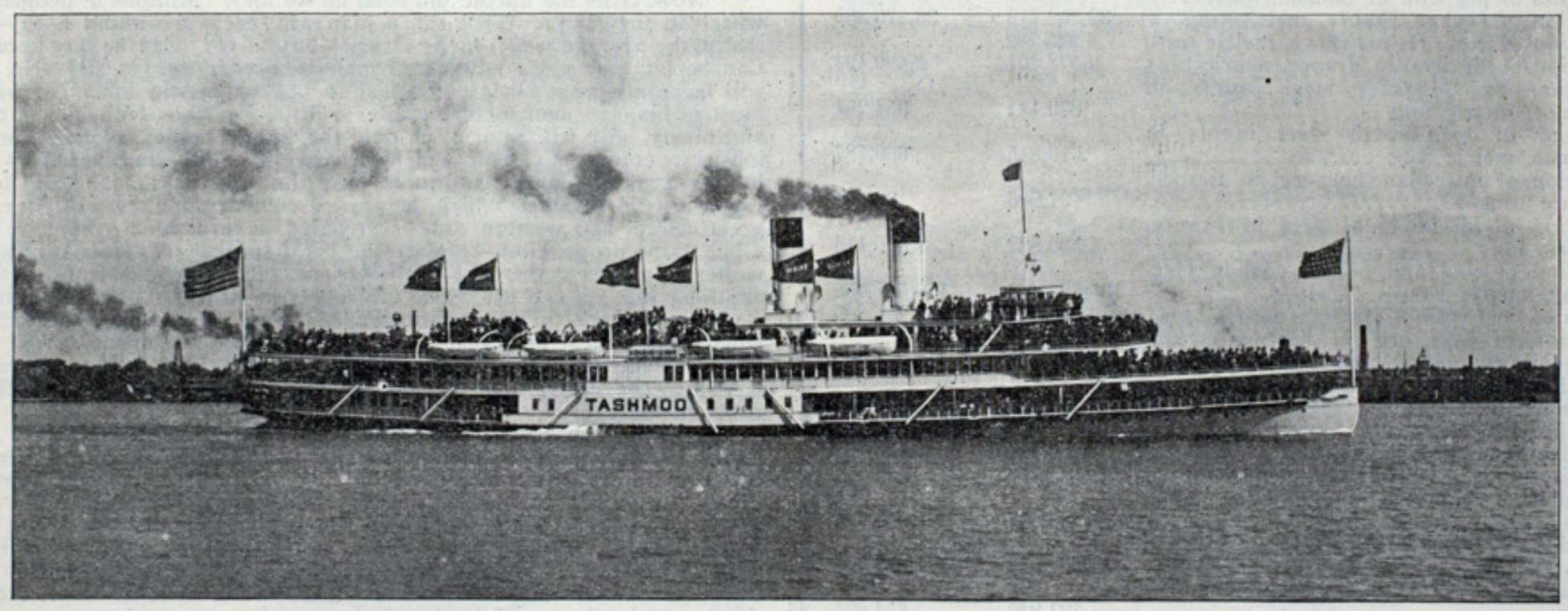
Both vessels are models in their class. The Tashmoo, being exclusively a day boat, with no space given over to state rooms, is the trimmer ship, with fine yacht-like lines, but it is questionable whether there is in general excellence a finer side-wheeler afloat than the City of Erie. The contest will be between Cleveland and Erie, the tug Harvey D. Goulder marking the stake at Cleveland and the tug America at Erie.

Some large wagers have been made on the race, but the amounts "put up" and said to be in waiting have been greatly exaggerated in the newspaper reports. The Cleveland & Buffalo Transit Co. would certainly profit greatly by success with the City of Erie in the race. The Pan-American exposition business between Cleveland and Buffalo will be very large during the coming summer, and the card "fastest passenger steamer on the great lakes" would be quite an attraction to tourists, not for this season alone, but for some time to come.

To Meet in a Contest of Speed on Lake Erie June 4.



CLEVELAND & BUFFALO TRANSIT CO.'S STEAMER CITY OF ERIE.



WHITE STAR LINE STEAMER TASHMOO OF DETROIT.

SIGNALS FROM DETOUR STATION.

Lake vessels are often held off the entrance to Detour passage by fog when there is clear weather inside the passage. The inspector of the eleventh light-house district has therefore made arrangements for a system of signals at Detour light station that will remove uncertainty in the matter. On and after June 10 whenever it is foggy on Lake Huron off the entrance to Detour passage and the St. Mary's river with clear weather inside, the fog signal at Detour light station will sound alternate blasts of 8 and 3 seconds' duration, separated by alternate silent intervals of 2 and 47 seconds; thus: Blast, 8 seconds; silent interval, 2 seconds; blast, 3 seconds: silent interval, 47 seconds. When it is thick and foggy both inside and outside of Detour passage the signal will sound the same as heretofore, blasts of 8 seconds' duration separated by silent interval of 52 seconds, thus: Blast, 8 seconds; silent interval, 52 seconds; blast, 8 seconds; silent interval, 52 seconds.

Gio Ansaldo & Co., one of the large Italian ship building concerns, is said to be arranging for the dismissal of all its employes, about 2,000 men, at the ship yards in Sestri. It is reported that this course has been rendered necessary by the action of the Italian government in reducing shipping bounties.

INDUSTRIAL STATISTICS FOR 1899 AND 1900.*

Products—United States.	1899.	1900.
Shipments of Lake Superior iron ore, tons..	18,251,804	19,059,393
Total production of iron ore, tons.....	24,683,173	.....
Total production of coal, tons.....	226,553,564	.....
Exports of anthracite coal, tons	1,707,796	1,662,286
Exports of bituminous coal, tons	4,044,354	6,255,033
Shipments of Connellsville coke, net tons....	10,129,764	10,166,234
Total production of coke, net tons.....	19,668,569	.....
Production of pig iron, tons.....	13,620,703	13,789,242
Production of spiegeleisen and ferro-manganese, included above, tons.....	219,768	255,977
Approximate consumption of pig iron, tons..	13,779,442	13,177,281
Unsold stocks of pig iron, Dec. 31, tons.....	68,309	446,020
Production of Bessemer steel ingots and castings, tons	7,586,354	6,684,770
Production of Bessemer steel rails, tons.....	2,240,767	2,361,921
Production of open-hearth steel ingots and castings, tons	2,947,316	3,402,552
Imports of iron and steel, tons.....	172,774	209,066
Exports of iron and steel, tons.....	942,659	1,154,504
Imports of iron and steel, values.....	$15,800,579	$20,443,908
Exports of iron and steel, values.....	$105,690,047	$129,633,480
Imports of iron ore, tons	674,082	897,831
Imports of iron ore from Cuba, included above, tons	368,759	419,632
Imports of manganese ore, tons	188,349	256,252
Locomotives built by independent shops, number	2,473	3,153
Locomotives built by Baldwin Locomotive Works, included above number	901	1,217
Passenger and freight cars built by independent shops, number	123,893	124,106
Steel cars built, included above, number. ..	10,500	14,464
Miles of new railroad built	4,528	.....
Miles of completed railroad in the United States on Dec. 31.....	190,833	.....
Products—Foreign Countries.	**1899.**	**1900.**
Production of coal in Great Britain, tons....	220,094,781	225,170,163
Exports of coal from Great Britain, tons....	41,180,332	44,089,197
Production of iron ore in Great Britain, tons.	14,461,330	.....
Imports of iron ore by Great Britain, tons...	7,054,578	6,297,873
Production of pig iron in Great Britain, tons.	9,421,435	8,908,570
Production of Bessemer steel ingots in Great Britain, tons	1,825,074	1,745,004
Production of Bessemer steel rails in Great Britain, tons	838,148	759,844
Production of open-hearth steel ingots in Great Britain, tons	3,030,251	.....
Production of coal in Canada, tons.....	4,076,779	5,332,197
Production of pig iron in Canada, tons.....	94,077	86,090
Production of coal in France, metric tons...	32,862,712	33,270,385
Production of iron ore in France, metric tons.	4,985,702	.....
Production of pig iron in France, metric tons	2,578,401	2,699,494
Production of Bessemer steel ingots in France, metric tons	879,181	954,261
Production of open-hearth steel ingots in France, metric tons	619,845	669,787
Production of miscellaneous steel in France, metric tons	31,806	36,070
Production of all kinds of steel in France, metric tons	1,530,832	1,660,118
Production of coal and brown coal in Germany, metric tons	135,824,427	149,551,058
Exports of coal from Germany, metric tons..	13,943,174	15,275,805
Production of iron ore in Germany and Luxemburg, metric tons	17,989,665	18,964,367
Production of pig iron in Germany and Luxemburg, metric tons	8,117,594	8,494,852
Production of Bessemer and open-hearth steel ingots in Germany, metric tons....	6,290,434	6,645,869
Production of coal in Belgium, metric tons...	22,072,068	.....
Production of iron ore in Belgium, metric tons	201,445	.....
Production of pig iron in Belgium, metric tons	1,024,576	1,018,507
Production of crude steel in Belgium, metric tons	731,249	654,827
Production of coal in Spain, metric tons.....	2,565,437	.....
Production of iron ore in Spain, metric tons.	9,397,733	8,480,246
Production of pig iron in Spain, metric tons.	295,840	294,118
Production of Bessemer and open-hearth steel ingots in Spain, metric tons	122,954	.....
Production of coal in Sweden, metric tons...	239,344	.....
Production of iron ore in Sweden, metric tons	2,435,200	.....
Production of pig iron in Sweden, metric tons	497,727	.....
Production of all kinds of steel in Sweden, metric tons	273,454	.....
Production of iron ore in Italy, metric tons..	236,549	.....
Production of iron ore in Algeria, metric tons	550,941	.....
Production of coal in India, tons.....	4,937,160	.....
Production of iron ore in India, tons.....	60,725	.....
Production of pig iron in India, tons.....	19,631	.....
Production of coal in New South Wales and other Australia, tons	6,427,128	.....
Production of coal in Japan in 1898, metric tons	6,761,301	.....
Production of pig iron in Japan in 1898, metric tons	23,652	.....
Production of coal in Mexico, metric tons...	113,191	.....
Miles completed railroad in Europe at the end of 1898	167,511	.....
The world's railroad mileage at the end of 1898	466,599	.....

*From the Bulletin of the American Iron & Steel Association. Unless otherwise stated gross tons (2240 lbs.) are used.

J. J. HILL ON OUR COMMERCE OF THE FUTURE.

"The fight is on the high seas. The great traffic contest is between the Pacific on the one hand and the Suez canal and Cape Horn on the other." This is the way in which J. J. Hill of Great Northern Railway fame puts the commercial situation.

"It is not a fight between this section, or city, or road, or the other," continued Mr. Hill—"at least so far as I am concerned. It is a big question of traffic development; it is a question of commercial development and industrial development for the country at large. Our competitor is not here, not in New York, not in San Francisco; he is on the high seas. Our fight is national, or, rather, it is international. Our problem is to get hold of the commerce of the Pacific ocean and bring it across the Pacific and across the United States, instead of allowing it to be diverted around the globe via the Suez canal and Cape Horn."

Then he had a word to say regarding those who thought he was engaged in a traffic fight. Shoving his hand through his hair and striding quickly across the room, he said in a subdued tone full of energy: "All I desire is to be let alone, to be left in peace, and do what I can to develop the country's commerce, unhindered by petty jealousies and slanders.

"I do not expect to receive any blessings for my labors during this life," said Mr. Hill with a laugh. "But I shall try to lay the foundations of my work so deep," he continued, "that when I pass from the scene it will not be necessary for those who follow to dig it all up and begin over again. Now, look at it broadly, what is the situation? What of our commercial future? Turn to our rate of population growth. We are doubling every thirty years. We have multiplied more during the past thirty-five years than during the 300 preceding. From the landing of the Mayflower down to the close of the civil war we grew to 35,000,000, but since 1865 we have increased 41,000,000. At this rate during the next thirty years we may grow to 150,000,000.

"What shall we do with this population? How many can we use in manufacturing? We now employ less than one-quarter. At the most not over one-third, or 50,000,000, can be employed in manufactures, railroading, trade, and the professions. The bulk of the remaining 100,000,000 must go to the land. Where will they go? Not to New England with its rocky and unproductive hills. New England, to use a term in physics, is filled to the 'saturation' point. Nor will the south take much of the increase, with the exception of the Latin influx from Southern Europe. No; the great increase will be in the valleys of the Ohio, Mississippi, Missouri, and westward, the fertile prairies of the great central west and beyond, wherever irrigation is possible.

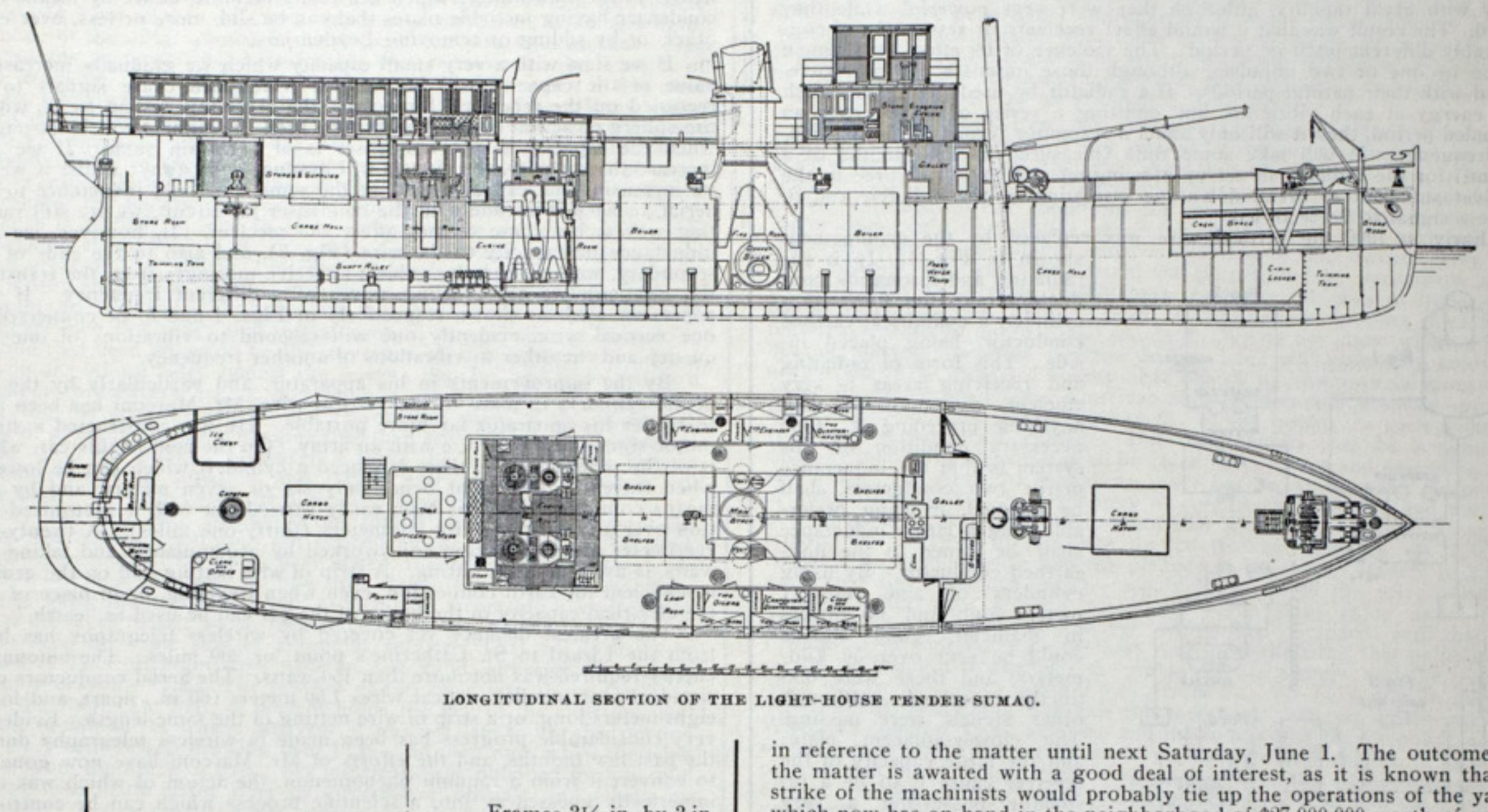
"Now, cross the Pacific and what do we find? Millions of people; and what can they buy? What can a man who earns a shilling a day—and that is the average wage of the Orient—buy of us? Can he buy luxuries? Can be buy anv great amount of manufactured goods at all? No. He will buy only what he is compelled to buy to sustain life. He will do most of his own manufacturing after a little, for labor with him is cheap and plenty. He will want of us onlv the simple staples, as grain, provisions, raw cotton, etc., from which to weave his cloth, and perhaps a little lumber, coal, and some hand tools. But the principal demand will be for food—just the products which the present coming population of America's great central and western zone is prepared to furnish. So here we have a big traffic proposition—to place the great surplus staples of central and western America at the door of the Orient, and bring back from the latter anything that we can use. The future has in store for us along this line a vast commerce. The next question is, how shall it be handled? By what route shall it go? Shall America handle it, or Europe? Will it go by the Pacific, or by the Suez and Horn? I hope that America will handle it, and by the Pacific. Geography and nature declare it and trade cannot resist them."

Mr. Hill then brought out from a stack of atlases a number of maps giving ocean distances, showing that Puget sound, by the great meridian circles, is the short cut for commerce, not only with Japan and Northern China, but with Manila and the entire Pacific coast of Asia. "We come now," he said, "to the resources of the Burlington territory. The Burlington has food and fuel to a degree not possessed by any other transportation system. Reaching from Chicago to Denver, and from the Twin Cities to St. Louis and Kansas City, it covers the richest and most diversified zone in the world in the production of grain, and provisions, and fuel. Now, what do these central prairies of Illinois, Iowa, Missouri and Nebraska require in return? They need lumber. From where is the lumber to come? From Washington and British Columbia. That is the only region with a heavy lumber surplus. Now look at the volume of this traffic. The great central belt between the Alleghenies and the Rockies consumes something like 10,000,000,000 ft. of lumber annually, and produces perhaps half of that. Some of this will come from the south, but the bulk from the Puget sound country.

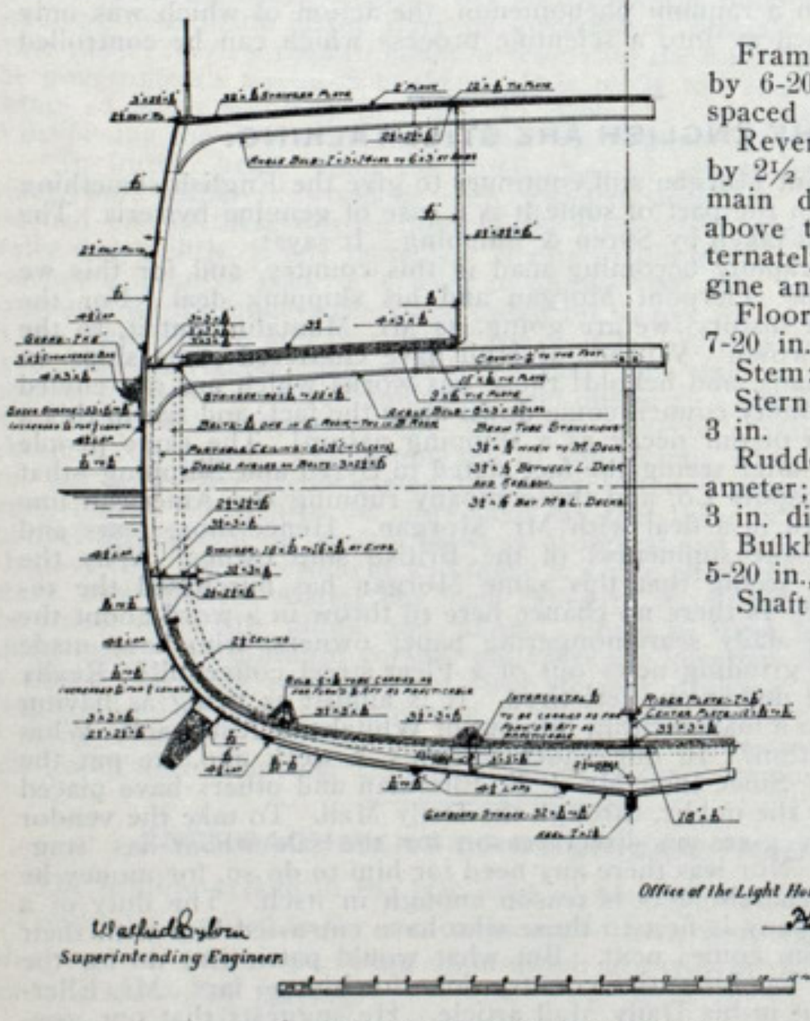
"Thus, on the one hand, we have a vast surplus volume of grain, provisions and fuel in the Mississippi and Missouri valleys seeking eastern and western outlets, and a similar large surplus product of lumber in the Puget sound country likewise pushing for markets, and especially for the treeless prairies of the Mississippi and Missouri. Now, grain, provisions, fuel and lumber constitute the principal heavy staples which govern traffic and make traffic routes. What, then, have we reached? We have a tremendous volume of traffic across the northwest between Puget sound and the Mississippi valley. The northern roads will carry westward the meat, and corn and coal, together with the raw cotton originating within Burlington territory at St. Louis and will place these products on the Pacific docks for export to Asia, and for the return trip the freight trains will bring back lumber for the central west and east. Nature and her products govern transportation routes and traffic; we railway men can simply get in line or fall out by the way. Now, these facts, which I have gone into farther than I intended, demonstrate the future of a great northwestern trade, do thev not?"

CONSTRUCTION OF LIGHT-HOUSE TENDER SUMAC.

Bids have again been solicited by the light-house board for the construction of the twin-screw steel steam light-house tender Sumac for the ninth light-house district of the great lakes. The general dimensions of the vessel are: Length over all, 168 ft. 10 in.; length between perpendiculars, 160 ft.; beam, molded, 30 ft.; depth of hold from top of main deck beam to top keel amidships, 14 ft. 1 in. The vessel is to be constructed of steel throughout and all the material used in the construction must be of American manufacture. There will be five main water-tight bulkheads and two water-tight flats at ends, forming perfectly water-tight trimming tanks forward and aft. The vessel will be equipped with two vertical, inverted, direct-acting, open front, jet-condensing, fore-and-aft compound engines with cylinders of 18 in. and 34 in. diameter, and a common stroke of 28 in. driving right and left handed, four-bladed cast iron propellers of the solid type, about 7 ft. 6 in. in diameter and a suitable pitch of screw. Steam will be furnished by two Scotch boilers, designed for a working pressure of 120 lbs. per square inch with a mean diameter of 12 ft. 3 in. and 12 ft. in length. The vessel will also be fitted with a donkey engine and boiler. Bids have been twice before solicited for the construction of this vessel, but at no time came within the appropriation of congress.



LONGITUDINAL SECTION OF THE LIGHT-HOUSE TENDER SUMAC.



Frames 3½ in. by 3 in. by 6-20 in. to 5-20 in., spaced 22 in. apart.

Reverse frames: 3 in. by 2½ in. by 5-20 in. to main deck, and 12 in. above turn of bilge alternately; double in engine and boiler space.

Floors: 16½ in. by 7-20 in.

Stem: 7 in. by 2 in.

Stern post: 6½ in. by 3 in.

Rudder head: 5 in. diameter; heel and pintles 3 in. diameter.

Bulkheads: 6-20 in., 5-20 in., 4-20 in.

Shaft tunnel: 6-20 in.

Office of the Light House Board, April, 1900.

Warfield Taylor
Superintending Engineer.

Thomas Perry
Captain, U. S. N.,
Naval Secretary

CROSS SECTION OF THE SUMAC.

It is unofficially announced that the net earnings of the United States Steel Corporation during April were $9,000,000, about equalizing the net earnings for March. This is at the rate of $108,000,000 per annum, ample to meet all fixed charges and to declare, if deemed advisable, a dividend on the common stock.

LABOR QUESTION AT NEWPORT NEWS.

Newport News, Va., May 29.—Ever since the strike of the machinists began May 22, there has been an air of expectancy noticeable among the workingmen at the great ship yard in this city, where hundreds of skilled machinists are employed. Various sensational rumors have been started regarding the status of affairs between the men and the company, but most of them have been run down and found to be without foundation. From what can be learned fully 90 per cent. of the machinists employed here are opposed to going out on the basis set forth in the order of the international union. The outside machinists, however, are said to have a grievance, and it is reported that a committee from the union called upon General Superintendent Post and endeavored to reach an agreement concerning these matters. It is reported that the yard asked for a delay in reference to the matter until next Saturday, June 1. The outcome of the matter is awaited with a good deal of interest, as it is known that a strike of the machinists would probably tie up the operations of the yard, which now has on hand in the neighborhood of $27,000,000 worth of naval and merchant contracts. There are now 7,110 men on the pay roll at the yard, and a nine-hour day with ten hours pay for the machinists would inevitably lead to dissatisfaction among the other men and would probably mean a demand for extension of the system to all the men employed in the yard.

AN IMPORTANT LAKE ERIE LIGHT.

Amherstburg, Ont., May 29.—Col. William P. Anderson, chief engineer of the department of marine and fisheries, will be here during the latter part of the week when a crib for the new light-house on Pelee Middle ground will be towed to its destination. It is not the fault of the marine department that this new light-house is not to be placed on Southeast shoal as requested by a great many of the vessel masters. Col. Anderson spent three or four days about the middle of the month on Southeast shoal with Mr. W. J. Stewart, in charge of our hydrographic survey, examining the shoal, to see whether a foundation suitable for a light-house could be found. These officers found everywhere fine sand, into which they could sink a rod to a considerable depth. They also found evidence that the surface of the shoal had changed materially since it was last surveyed by the U. S. S. Michigan in 1895. They particularly examined the shoalest spots shown on the United States hydrographic chart No. 1543, and the patches marked rocky, but it was all alike, fine sand. Col. Anderson says he was therefore forced to the conclusion that his previous information about it, that it was a shifting sand shoal, was correct, and this compelled him to decide on placing the new light-house on the Middle ground as originally intended. The illuminating apparatus to be put into this new light-house will be modern, quick, double-flashing light, with the following characteristic: Flash, .58 second; eclipse, .85 second; flash, .58 second; eclipse, 5.48 seconds; total period, 7.50 seconds.

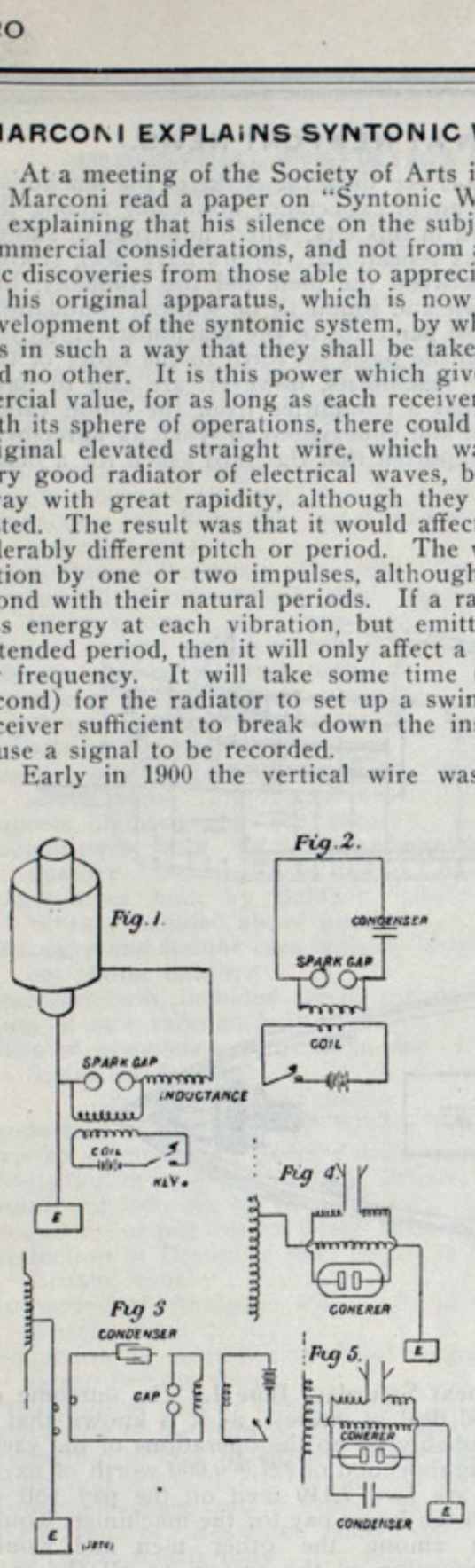
REMARKABLE RESULTS WITH MAXIMITE.

Reports of tests made during the past few weeks at the government proving ground at Sandy Hook show that the United States is still very much in the lead in the matter of high explosives. Maximite is the explosive from which great results have been obtained. It is named for the inventor, Hudson Maxim. Its composition is a government secret. The Maxim system provides a high explosive which can be loaded into a service, armor-piercing shell, and on account of its insensitiveness to shock, can be carried through any thickness of armor that the shell can penetrate, and be exploded by a time-fuse at the rear of the plate. In the recent Sandy Hook trials shells of all sizes, from 6 pounders up to 12 in., carried their loads of the new explosive through armor plates of 3 to 12 in. thickness, and either exploded the charge in the plate or just beyond it. The new compound is far more powerful than wet guncotton. It has an explosive value equal to that of nitro-gelatine and picric acid, and it can not only be fired from powder guns at the highest velocity with safety, but will withstand the far greater shock of penetrating any armor plate that the projectiles themselves can get through.

MARCONI EXPLAINS SYNTONIC WIRELESS TELEGRAPHY.

At a meeting of the Society of Arts in London on the 17th inst. Mr. G. Marconi read a paper on "Syntonic Wireless Telegraphy." He began by explaining that his silence on the subject in the past was the result of commercial considerations, and not from any desire to withhold his scientific discoveries from those able to appreciate them. After a brief mention of his original apparatus, which is now well known, he turned to the development of the syntonic system, by which it is possible to send messages in such a way that they shall be taken up by one particular receiver, and no other. It is this power which gives to wireless telegraphy a commercial value, for as long as each receiver responded to every transmitter with its sphere of operations, there could be nothing but confusion. The original elevated straight wire, which was used as a transmitter, was a very good radiator of electrical waves, but its electrical oscillations died away with great rapidity, although they were very powerful while they lasted. The result was that it would affect receivers or resonators of considerably different pitch or period. The violence of its effect set them in action by one or two impulses, although those impulses did not correspond with their natural periods. If a radiator be used giving off much less energy at each vibration, but emitting a series of waves over an extended period, then it will only affect a resonator turned to that particular frequency. It will take some time (measured in thousandths of a second) for the radiator to set up a swinging electromotive force in the receiver sufficient to break down the insulation of the coherer, and to cause a signal to be recorded.

Early in 1900 the vertical wire was replaced by the arrangement shown in Fig. 1. In it the radiating and resonating conductors take the form of a cylinder, a cylindrical earthed conductor being placed inside. This form of radiating and receiving areas is very efficient, as compared with anything preceding it. One necessary condition of this system is that the inductance of the two conductors shall be unequal, it being preferable that a large inductance shall be joined to the non-earthed conductor. By using cylinders of zinc only 7 meters high and 1.5 meters in diameter, good signals could be sent over 50 kilometers, and these were distinctly received, although other signals were passing. The closely-adjacent plates and the large capacity of the receiver cause it to be a resonator possessing a very decided period of its own, and so no longer apt to respond to frequencies which differ from its own particular period. The receiver is not shown in Fig. 1, but consists of similar cylinders, the receiving induction coil, or oscillation transformer, being placed where the spark gap is in the old apparatus.



Another very successful syntonized transmitter and receiver were the outcome of a series of experiments carried out with the discharge of Leyden jar circuits. Since the chief difficulty with the old system was that the oscillations were so very dead beat, there was associated with the radiator wire a condenser circuit, which was known to be a persistent oscillator, to set up a series of persistent oscillations in the transmitting vertical wire. An arrangement is shown in Fig. 2, consisting of a circuit containing a condenser and spark gap, and this constitutes a very persistent oscillator. It is sufficient to place near one of its sides a straight metal rod or good electrical radiator; the only other condition necessary for long distance transmission is that the period of oscillation of the wire or rod shall be equal to that of the nearly closed circuit. Stronger effects of radiation are obtained if the radiating conductor is partly bent round the circuit, including the condenser, so as to resemble the circuit of a transformer.

An arrangement was first constructed consisting of a Leyden jar or condenser circuit, in which was included the primary of what may be called a Tesla coil, the secondary of which was connected to the earth or aerial conductor. The idea was to associate with the compound radiator a receiver tuned to the frequence of the oscillations set up in the vertical wire by the condenser circuit. The first trials were not successful, because the necessity was not recognized of attempting to tune to the same period of oscillation (of octaves) the two electrical circuits of the transmitting arrangement (these circuits being the circuit consisting of the condenser and primary of the Tesla coil or transformer), and the aerial conductor and secondary of the transformer. Unless this condition is fulfilled, the different periods of the two conductors create oscillations of a different frequency and phase in each circuit, with the result that the effects obtained are feeble and unsatisfactory on a tuned receiver. The syntonized transmitter is shown in Fig. 3. The period of oscillation of the vertical conductor can be increased by introducing turns, or decreased by diminishing their number, or by introducing a condenser in the series with it. The condenser in the primary circuit is constructed in such a manner as to render it possible to vary its electrical capacity.

The receiving station arrangements are shown in Figs. 4 and 5. Here we have a vertical conductor connected to earth through the primary of a transformer, the secondary circuit of which is joined to the coherer or detector. In order to make the tuning more marked, an adjustable condenser is placed across the coherer in Fig. 5. Now, in order to obtain the best results, it is necessary that the free period of electrical oscillations of the vertical wire primary of transformer and earth connection should be in electrical resonance with the second circuit of the transformer, which includes the condenser.

In order that the two systems, transmitter and receiver, shall be in tune, it is necessary (if we assume the resistance to be very small or negligible) that the product of the capacity and inductance in all four circuits should be equal. Experiments have confirmed the fact that the receiving induction coils, having the secondary wound in one layer and at a certain distance, say two millimeters (to cause the capacity to be so small as to be negligible), have a time-period approximately equal to that of a vertical conductor of equal length. If, therefore, we are using an induction coil having a secondary forty meters long on the receiver, we should use a vertical wire forty meters long at both transmitting and receiving stations. By so doing we have the two circuits at the receiving station in tune with each other, and only have to adjust the capacity of the condenser at the transmitter, which can easily be done, either by means of a condenser having movable plates that can be slid, more or less, over each other, or by adding or removing Leyden jars.

If we start with a very small capacity which we gradually increase, a value of the capacity will be reached which will cause signals to be recorded on the receiver. Supposing the receiving system to be within the sphere of action of the transmitter, then the signals will be strongest when the capacity of the condenser is of a certain value. If we still increase the capacity, the signals will gradually die away; whilst if we go on increasing the capacity, and, at the same time, add inductance to the aerial, to keep it in tune with the condenser jar circuit, we are still radiating waves; but these do not affect the receiver. If, however, we add inductance or capacity to the wire (Fig. 5), and also to the ends of the secondary, we find ourselves able to receive messages from the transmitter, although we are utilizing waves of a different frequency. If two apparatus, such as shown respectively in Figs. 4 and 5, be connected to one vertical wire, evidently one will respond to vibrations of one frequency and the other to vibrations of another frequency.

By the improvements in his apparatus, and particularly by the use of the cylinders in place of the vertical wire, Mr. Marconi has been able to render his apparatus far more portable. He has constructed a steam motor-signaling car for use with an army. On the roof of this car, which is of the omnibus type, there is placed a cylinder, which can be lowered when traveling, its height being only six or seven meters, and by this means communication has been easily carried out with a syntonized station over a distance of fifty kilometers (thirty-one miles). A twenty-five centimeter spark induction coil, worked by accumulators and taking 100 watts, is used for transmitting. A strip of wire netting laid on the ground is sufficient for earth connection, even when traveling, or in place of this the electrical capacity of the boiler of the car can be used as "earth."

The greatest distance yet covered by wireless telegraphy has been from the Lizard to St. Catherine's point, or 200 miles. The amount of energy required was not more than 150 watts. The aerial conductors consisted of four parallel vertical wires 1.50 meters (60 in.) apart, and forty-eight meters long, or a strip of wire netting of the same length. Evidently very considerable progress has been made in wireless telegraphy during the past few months, and the efforts of Mr. Marconi have now gone far to convert it from a random phenomenon, the action of which was only imperfectly guessed at, into a scientific process which can be controlled and utilized.

THE ENGLISH ARE STILL TALKING.

Mr. J. Pierpont Morgan still continues to give the English something to talk about. On the part of some it is a case of genuine hysteria. The sanest view is that taken by Syren & Shipping. It says:

"People are rapidly becoming mad in this country, and for this we have to thank Mr. Pierpont Morgan and his shipping deal. For the 999th time in our history, we are going, as Mr. Mantalini put it, to the 'deminition bow-wows.' Wilsons of Hull have chartered some ships on time to the Russians, and behold! those gas works which are not envied by the London county council come down upon the fact, and see in this a further indication of our decay as a shipping nation! The same people have discovered—after seeing the fact stated in Syren and Shipping—that the Atlantic Transport Co. and the company running the American line are also concerned in a deal with Mr. Morgan. Hence more tears and more reviling of the supineness of the British ship owner. Why the ship owner only, seeing that this same Morgan has purchased the recovered Duchess? Is there no chance here to throw in a word about the supineness of the daily scaremongering paper owners, who have made many shekels by grinding news out of a Fleet street coffeemill? Really this sort of thing makes one feel tired. It is almost as tiring as having to sit and listen to a man reciting bits out of Whitaker's Almanack. What is really the position? In our leader columns, a week ago, we put the position broadly. Since then Mr. J. R. Ellerman and others have placed their views before the public, through the Daily Mail. To take the vendor chairman first, he gives no direct reason for the sale which has 'staggered humanity.' Nor was there any need for him to do so, for money he obtained for his shareholders is reason enough in itself. The duty of a director of a company is first to those who have entrusted him with their money. Patriotism comes next. But what would patriotism do for the ship owner; what has his native country done for him so far? Mr. Ellerman roughs it out in his Daily Mail article. He suggests that our governments have successively proceeded on the footing that thirty-year-old conditions are good enough now. Ancient acts of parliament are kept on the statute book, and ship owners are made to comply with them, although the provisions are obsolete. It is so throughout his article, and it is indisputable that his contention is right. Nationally speaking, we do neglect our merchant marine, and to a most shameful extent. Ourselves and a few others are like one crying in the wilderness, and the wilderness is a very huge one. If this sale of the Leyland line to America will waken up our legislature to the necessity of dealing in a statesmanlike—or even sensible—way with the disabilities under which the shipping trade of this country labors, then surely a niche in some stately abbey should be Mr. Ellerman's when he goes hence. But we fear that there is no such happy chance."

George Gilchrist of Belfast, Me., has laid the keel of a four-masted wooden schooner for McQueston Bros. of Boston.

DEPTH OF WATER IN ST. LAWRENCE CHANNELS.

A great deal of matter has appeared in the press recently in reference to the depth of water in the upper St. Lawrence channels, some captains and pilots being reported as saying that it is all right for vessels drawing 14 ft. and others contending to the contrary. Capt. T. Donnelly of Kingston, chief inspector for the Canadian lake underwriters, was quoted as doubting the existence of a clear 14-ft. channel. The Railway & Shipping World of Canada sent the clippings to Capt. Donnelly for an explanation. He replied as follows:

"I do not wish to enter into a controversy at long range with our Canadian pilots, and I have no wish to be considered as finding fault with our St. Lawrence river waterway, the finest stream of fresh water on the face of the globe, and one that only needs a little more attention from the government to make it a safe and navigable stream for vessels drawing 14 ft. of water. My views have been published at some length, and none of the pilots quoted in the request that you send me have ever disputed any statement that I have made with reference to the draught of water available. On talking to the pilots about the matter, I find that they are not always correctly reported in the press, and as I know every one of them intimately, I do not wish to find fault with any statement credited to them by the every-day newspaper reporter. The pilots have no responsibility in the matter whatever, from a financial point of view, and you can easily understand that as all these steamers and their cargoes are insured, the underwriters are not going to allow vessels (on which insurance is carried) to load to 14 ft., unless we are certain that there is a navigable channel of 14 ft. draught. Governments in the past have done a great deal for the St. Lawrence channel, and the present government is very anxious to improve it to the best of its ability. I am not one that wants to find fault with their work, but there are so much politics to the square inch in Canada that just as soon as one points out matters of this kind that need attention by the government, it is at once considered that you are taking sides against the powers that be, and immediately a newspaper controversy begins, and yet you cannot gain any satisfaction by writing the departments, for the reason that some of the officers in charge of government work imagine that they are working for themselves instead of for the public. However, I think the government at Ottawa now understands the situation, and I have every confidence that it will do the best it can to remove the difficulties now existing.

"My idea of a 14-ft. channel is one that is navigable all through the season of navigation, and does not depend on the direction of the wind. It may be, as some of the pilots have stated, that there will be 14 ft. early this year, but none of us can tell how long it will last; it depends upon the height of water above normal level. If men start steamship lines from the head of the lakes to salt water, they have to depend on the vessels being able to keep up some sort of a regular service. Last fall boats were detained at Prescott eight days with an east wind, although the vessels were only drawing 12 ft. The portion of the river just above Cardinal, and in the Rapid De Plat, at present holds the key of the situation, and from the middle of the season last year, it was not safe to use this portion of the river with vessels drawing over 12 ft., and then only when the wind was not from the north or east. My information is obtained from careful sweeping tests made in the river by government officials, and I have no other object in view than to assist in removing the obstructions by calling the government's attention to them. It is really too bad that one has to obtain so much notoriety in doing it. There has been no change made in deepening the river since the last test was made in November, 1900.

"In former years when the small class of vessels drawing 9 ft. of water, built either of wood or with wooden sheathing on the bottom, touched one of these obstructions in the river. they glanced off it, generally doing little, if any damage. If one of our modern steel steamers touches a lump of rock it is hard to shove 3,000 tons to one side, and consequently the underwriters are called on to pay for very large repairs to the steel plating and framing of the vessels. Why we are anxious to have a safe, navigable channel is very clear. This trade from the lakes in modern steamers is just commencing and one or two bad groundings will work irreparable damage to the Montreal trade in so far as the upper lakes are concerned. I can point out to you exactly where the bad spots are, but as I have freely stated their position in former letters to the press, I have no wish to do more than say that there is not a safe 14-ft. channel throughout the season between Montreal and Kingston, although I believe that the government will make it a safe channel in the very near future, now that the matter has been called to its attention. Of course, you know there are 'pilots' and 'pilots.' Some of them know all about taking down light-draught vessels, but there are very few that know how to safely take care of a modern steel steamer drawing 14 ft. between Kingston and Montreal at any time of the season, and it is hard for any of them, from lack of experience, to realize what it means to have 3,000 tons going down the river 12 miles an hour under their control."

ENCROACHMENT OF AMERICAN TRADE.

The leading article in the last issue at hand of the Shipping World of London is devoted to the encroachment of American trade upon English commerce, the single string upon which so many of the English publications are today playing.

"The events that are transpiring in shipping circles," it says, "and the arrangements that are in progress for a complete system of transportation from the far and near west over the railways, by lake steamers and over the Atlantic to Europe deserve the most serious consideration of parliament and the government. If we could induce cabinet ministers and honorable members to read a portion of the speech made by the chairman at the general meeting of Messrs. Frederick Leyland & Co. Ltd., last Tuesday, their eyes might be opened to the dangers in our path. Mr. Mattison, speaking of the provisional agreement entered into between Mr. Ellerman, the chairman of the company, and Mr. Pierpont Morgan, said that in itself the transaction was little more than the purchase by American capitalists of a controlling interest in an English company; but he did not desire in any way to minimize the possible significance of this transaction in its ulterior aspects. The fact that it was possible that the eventual outcome might be the transfer of a considerable trade from the British to the American flag conveyed more than a hint. It was a distinct warning which ought to be laid to heart by every person who was interested in the supremacy of British trade. It was often said that trade followed the flag. That was true, but it was not the whole truth. Trade followed also the capital which created the trade. Capital had no country. By the operation of an economic law as inexorable as any of the laws of nature capital would gravitate to those countries where it was most encouraged and least harassed. In view of that fact, he thought it would be the part of wisdom, instead of indulging in lamentations over the imminent decline of British trade, if they were to make timely inquiry whether there were or were not conditions in operation at the present time which, in many trades, rendered it less profitable to employ capital under the British flag than under a foreign flag, and if the answer to that question must be in the affirmative, and if it further appeared that these conditions were likely to be aggravated and accentuated in the near future, then he maintained that it would be the part of wisdom if they were persistently and urgently to make further inquiry as to whether it was not possible that these conditions might be removed, or at least their effects mitigated, by wiser and more intelligent legislation, by less obsolete and harassing methods of administration, and perhaps by a less rigid adherence to an antiquated fiscal policy.

"In this statement from Mr. Mattison the idea is clearly conveyed, first, that British shipping is not treated on business principles by the government; and second, that this great historic Leyland fleet of merchantmen has passed to the control of Americans because the capital invested will enjoy better conditions for earning a fair return to the investor than could be the case under the British flag. We have invited attention to the disadvantages under which British ship owners carry on their business, disadvantages created and perpetuated by parliament, and created chiefly in absolute recklessness regarding the laws of trade, the nature of competition, and the need of considering shipping laws and regulations from an international standard. We do not know whether the fleet of Messrs. Frederick Leyland & Co., Ltd., will ultimately enjoy a proportion of the proposed bounty of $9,000,000 to American shipping engaged in the foreign trade. American ship builders will possibly—probably, indeed—oppose giving the benefits of the bounty to such a large volume of foreign-built tonnage. But the difficulty may be accommodated by increasing the subsidy to be voted by congress and extending its application; and since the republican party has become not the old party of human liberty, but the machinery of commercial bondage and monopoly, there is, perhaps, but little doubt that when Mr. Pierpont Morgan crossed the Atlantic to purchase the controlling influence of Messrs. Leyland, he brought with him the pledges of republican leaders in congress that the American register would be given to the merchantmen acquired. But what are the conditions which ships enjoy under the American flag, or indeed almost any foreign flag, compared with that of Britain? Our supremacy on the seas is so overwhelming that politicians cannot be brought to consider the rights of ship owners, and the possibility of that supremacy passing away from us. We have now in measured tonnage something like half the merchant shipping of the world. When the superior speed and size and machinery and the preponderance of steam over sail in our merchant navy are taken into account, in a comparison with the merchant fleets of other countries, then it becomes plain enough that our carrying power is a great deal more than half the world's aggregate.

"This condition of things in part accounts for the tendency of governments and departments to treat shipping on other than ordinary business lines; to consider interference that would be intolerable in connection with any other industry quite legitimate and necessary when applied to shipping. The Americans pay no light dues; and they levy tonnage dues upon British ships by way of retaliating upon the British government for exacting light dues from American ships. It is a traditional fallacy that the royal navy is kept up to protect the merchant marine; and that therefore ship owners should contribute towards the government, not only in the way of ordinary people but in exceptional ways. The royal navy is maintained at a great cost to protect and preserve the national life, and to enable all the trades in common with the shipping trade to prosecute their undertakings. All the trades are closely interwoven in the national pattern; and to say that the ship owner should pay more than the ship builder, or the iron master, or the coal owner, towards lighting our coasts, enabling the royal navy to reach harbor in safety, is to display ignorance or indifference or to perpetuate an injustice. Moreover we enforce absurd restrictions on the passenger traffic. We collect consular fees in connection with shipping that have been abolished at least a dozen years in the United States. We insist upon loading, manning, and victualing regulations from which the tonnage of other countries enjoy something approaching complete immunity, even in our own ports. We are far from complaining of these regulations. What we do complain of is the callous indifference displayed by the government and the board of trade to the representations of ship owners that all these questions should be treated internationally, and that an endeavor should be made by the government whose citizens own the preponderating share of shipping, to get other nations to agree to just, equitable, uniform laws and rules, framed to avoid confusion and conflict, and to save life and property at sea."

Twenty millions is the capital of the Algoma Steel Co., latest of the Clergue enterprises at Sault Ste. Marie, Ont. In addition to the manufacture of iron, steel and nickel and their products for all purposes, the company is authorized by its Canadian charter to manufacture charcoal, coke and to deal in wood and its products, and to construct and acquire vessels.

"Everything for Power" is the name of an interesting publication issued by the Jewell Belting Co., 175-77 Lake street, Chicago. They have hit upon a very attractive baby picture for the card advertising the book. "Everything for Power" will be sent without charge to everybody who will ask for it.

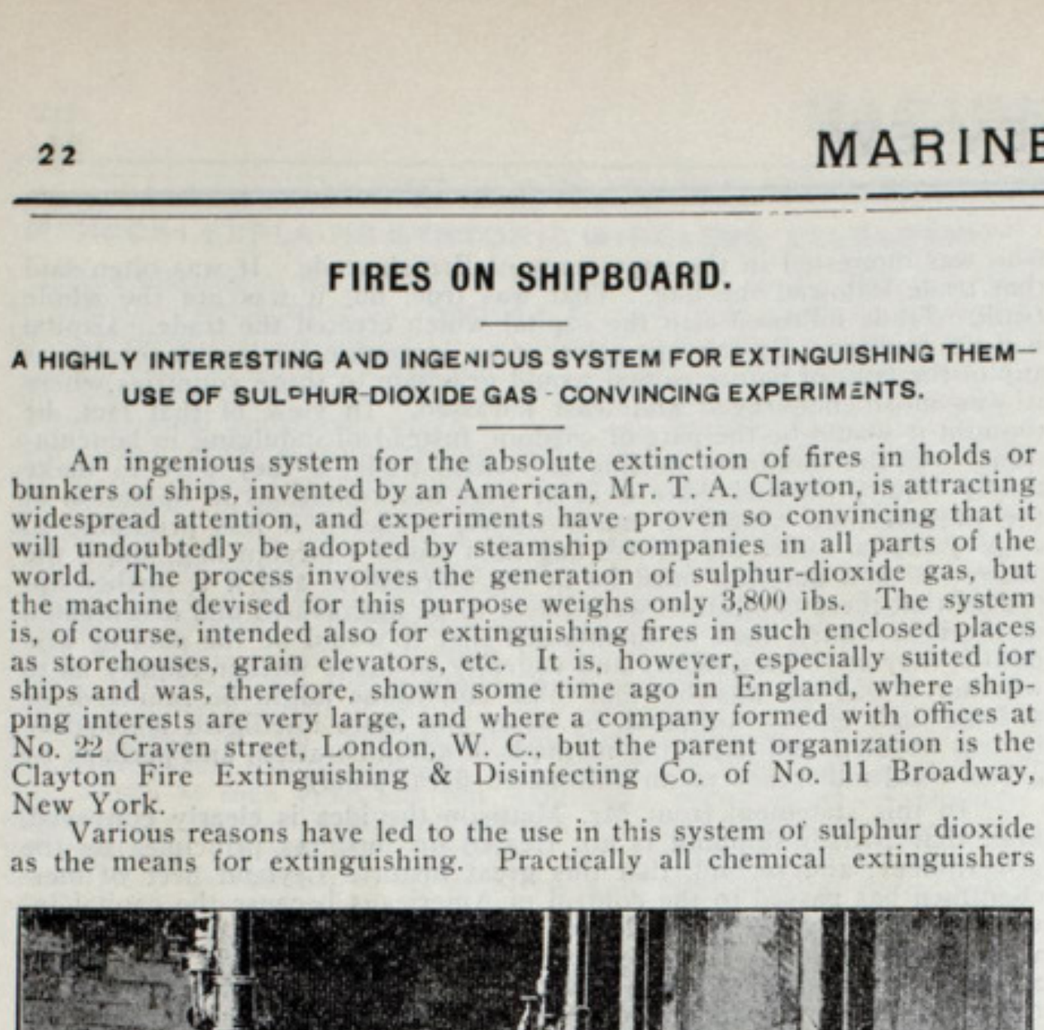
One fare for the round trip to the Pan-American exposition at Buffalo via the Nickel Plate road beginning June 1 and continuing the entire summer; good returning within ten davs from date of sale. Write, wire, 'phone or call on nearest agent, or E. A. Akers, C. P. & T. A., Cleveland, Ohio.
84, Aug. 1.

FIRES ON SHIPBOARD.

A HIGHLY INTERESTING AND INGENIOUS SYSTEM FOR EXTINGUISHING THEM—USE OF SULPHUR-DIOXIDE GAS—CONVINCING EXPERIMENTS.

An ingenious system for the absolute extinction of fires in holds or bunkers of ships, invented by an American, Mr. T. A. Clayton, is attracting widespread attention, and experiments have proven so convincing that it will undoubtedly be adopted by steamship companies in all parts of the world. The process involves the generation of sulphur-dioxide gas, but the machine devised for this purpose weighs only 3,800 ibs. The system is, of course, intended also for extinguishing fires in such enclosed places as storehouses, grain elevators, etc. It is, however, especially suited for ships and was, therefore, shown some time ago in England, where shipping interests are very large, and where a company formed with offices at No. 22 Craven street, London, W. C., but the parent organization is the Clayton Fire Extinguishing & Disinfecting Co. of No. 11 Broadway, New York.

Various reasons have led to the use in this system of sulphur dioxide as the means for extinguishing. Practically all chemical extinguishers



depend for their efficiency upon the liberation of carbonic acid gas, and in the popular mind this is generally considered the most effective enemy to combustion. Investigations made demonstrated the rather peculiar fact that quenching a fire by this method is not the result of the attenuation of the oxygen, because various gases require to be added in varying amounts to the atmosphere surrounding a fire before it will be quenched. About 15 per cent. of carbonic acid gas must be injected to quench a brisk blaze. Those who developed the Clayton system have found in their experiments with sulphur dioxide that less than 5 per cent. will accomplish this result, even when the blaze is extremely fierce. Therefore it appears that there is some inherent property in sulphur dioxide which makes it especially valuable for this purpose. The specific gravity of the gas is 2.2 of that of air and 1.5 of that of carbonic acid.

Besides these two superior qualities the fact that the gas can almost instantaneously be developed in large quantities and in very simple manner led to its adoption. The gas is generated by the combustion of crude brimstone, and in about five minutes after starting the machine every particle of oxygen entering the furnace containing the burning sulphur is being utilized. This in itself is a feature of importance, because when all the oxygen is combined with the sulphur the result is a mixture of only nitrogen and sulphur dioxide, both enemies to fire. A highly important feature of the system is that after the fire is extinguished the charged atmosphere in the inclosed space or compartment in which the fire was raging is pumped back into the chamber after passing through a cooler. Thus there is added to the fact that the fire is surrounded by an atmosphere incapable of supporting the combustion, the fact that the circulation of that atmosphere through the cooler lowers the temperature in the chamber to such a point that reignition is impossible.

The Review is indebted to the Iron Age of New York for the illustrations printed herewith and for a large part of the matter descriptive of this process. The generator, which it will be observed is very compact, is shown in the reproduction from a photograph. It consists of a jacketed furnace in which there are traps upon which the sulphur is burned. In the base of the machine is the cooler, consisting of a series of tubes through which the gases flow. On the same bed plate is the blower, driven by a small engine. The floor space required is 4 ft. 6 in. by 5 ft. 8 in. A very neat arrangement has been introduced. Sulphur when burned is apt to deposit from the gases some fine flower of sulphur, which in time might choke the flues of the apparatus. In order to avoid this by providing for complete combustion an auxiliary supply of air is introduced into the dioxide gas before it enters the cooler.

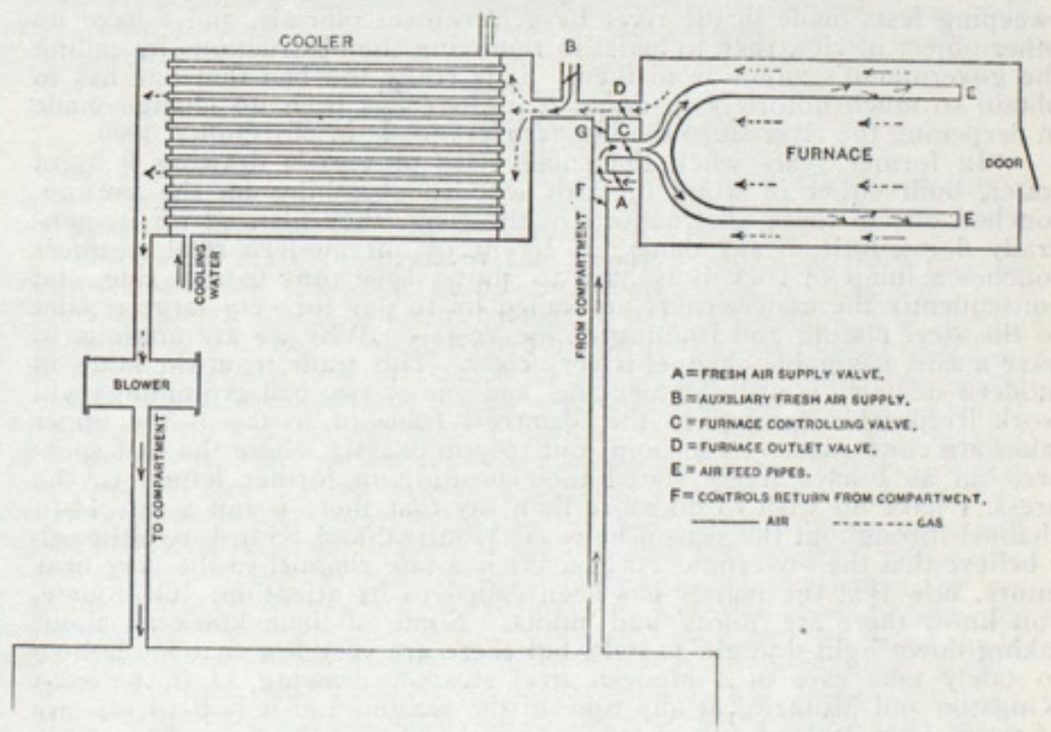
The diagrammatic sketch, fig. 3, will best serve to explain the details of the system. The sulphur dioxide produced by the combustion of the sulphur in the furnace flows through the outlet valve D, the hot gas meeting on its way to the cooler the auxiliary air supply entering through valve B. It is drawn by the blower through the cooler and forced into the compartment in which a fire is to be extinguished or ignition is to be prevented. The main air supply for the combustion of the sulphur is at A, and is made to impinge on the burning sulphur from perforations in the air feed pipes E. A valve, C, permits of controlling this air supply and of shutting it off altogether. When it is desired to stop the discharge of further sulphur dioxide into the seat of the fire, and to cool the atmosphere in the chamber, the valve F, which controls the return from the compartment, is opened and then the blower performs the function of drawing the gases through the cooler again and again, until the temperature is lowered sufficiently. These operations are carried on by means of a controller so designed as to permit of regulating the amount of oxygen entering into the compartment and at the same time obtain perfect combustion of the sulphur. By its use it is possible to obtain a pure gas at a temperature of less than 100°. This does away with any necessity of lagging the conducting pipes and the men are free to handle the pipes at any point. The system of distributing piping is simply that of using manifolds provided with valves and controlling the supply and exhaust pipe from each of the compartments—exactly similar to any ordinary system of steam or gas piping. Three inches is the largest diameter employed.

At Greenpoint Long Island, there is installed a Clayton apparatus, and there are two chambers, one of brick and the other of sheet iron, in which some very interesting and convincing experiments have been repeatedly carried out lately. In the former a lively bonfire was started. The doors were closed and the generator started. Through peep holes it was possible to observe clearly how rapidly the blaze deadened and finally died out entirely. Flaming torches thrust into the compartment went out immediately. Into the sheet iron chamber filled with sulphur dioxide a red hot plate was lowered directly upon a barrel filled with hay. The result was a charring of the hay at the area of contact, but no ignition. Similarly a red hot plate was dropped into a bucket of oil without causing any fire.

Highly suggestive experiments have also been made with cotton, which behaves in the same way. It is generally agreed among underwriters that fire is capable of lingering in the bales of cotton longer than in any commodity shipped in great quantities. Recently one of the experimental compartments was opened after a bale of cotton had stood in the gas for twenty hours. A sample drawn from the center of the bale not only smelled strongly of gas, but, when moistened with water, turned litmus paper red, thus proving how thoroughly the gas penetrates the bale.

Exhibitions of the system similar to those given at Greenpoint, Long Island, have also been conducted in London. Mr. Clayton conducted personally some of the London experiments several weeks ago. Fairplay, one of the leading shipping journals, says in an account of what occurred at that time:

"After several experiments with heated metal on a bale of hay and with a similar piece of metal placed in a bucket containing naphtha, a fire, consisting of pitch-pine firewood and shavings, saturated with kero-



sene, was set alight in the building and allowed to burn fiercely for about twenty minutes. The generator was then started, and within five minutes no trace of fire could be seen through the mica windows with which the compartment is provided, and the fire was extinguished with one of the doors of the compartment left open. It was pointed out by Mr. Clayton that if at this stage the generation of the gas was stopped and the compartment opened up so as to allow of the free admission of fresh air, the fire would burn up again through the action of the oxygen starting combustion in the charred material, as the temperature had not been reduced below the igniting point by the cooling process with which the generator was provided. To illustrate this point the generator was stopped, the compartment opened up, and in a few minutes the fire was burning as fiercely as ever. After the generator had again been set in motion, the fire re-extinguished, and the cooling process had been in operation for about twenty minutes, the compartment was opened up and no sign of fire was found, nor did the admission of fresh air cause reignition as in the previous case.

"In addition to the experimental compartment for fire tests, the company has had erected a smaller compartment for the purpose of demonstrating that the sulphur dioxide gas has no deleterious effect on any description of merchandise, providing the same does not contain any great percentage of moisture. Samples of tea, coffee, rice, flour, maccaroni, sugar, etc., were shown which had been submitted to a twenty-four hours' exposure of a high strength of the gas, and it was impossible to distinguish any difference between the samples which had been exposed and those which had not. This is looked upon as a very important point, the gas being a

well-known disinfectant, and, in fact, it has been used at the Mississippi river quarantine station and others in the United States for ten years past with highly satisfactory results. It will therefore be seen that a vessel or warehouse provided with this apparatus has not only the means at hand of preventing and extinguishing fires, but also of ventilating and disinfecting, without any danger of damage to such produce as described above, as well as such merchandise as cotton, jute, wool, hemp, flax, etc. It has been established by competent medical authorities that an 8 per cent. to 10 per cent. strength of this gas is thoroughly germicidal, and it naturally exterminates all rats and vermin that cannot escape from its presence. Mr. Clayton, who was himself one time chairman of the quarantine committee of the board of health of the State of Louisiana, described the effect of this gas on rats in ships' holds and it would seem that as soon as these annoying rodents perceive the presence of the gas they rush from their holes and hiding places and are found in heaps in the bottom of the holds of steamers in ballast, and on the top of the cargo, underneath the hatches, of cargo-laden steamers."

TO RESTRICT AMERICAN COMPETITION.

That there appears to exist in some quarters abroad an undercurrent of apprehension as to the effects of American competition has been sufficiently indicated from time to time in a variety of ways. Thoughtful statesmen have dwelt upon the control exercised by the producers of the United States over the resources at their command through the development of modern processes, and the pressure into their service of improved agencies of distribution, using the facts as a means of exhortation to the producers of their own countries. This has been the case in Great Britain, where the need of meeting American competition in certain directions has been brought home to business men. In some of the continental countries the apprehension has taken the form of proposals of legislation to prevent, or at least to restrict, the introduction of American products. Measures of this kind have been brought forward from time to time in individual countries, and occasionally, more frequently of late than in former times, rumors of alleged projected commercial alliances against the United States obtain currency.

One of these rumors takes the form of a report that negotiations are in progress between Germany and other powers looking to the formation of a commercial league of European nations against the United States. This rumor seems to have been based upon certain statements made in the Gazette of Cologne, which has sometimes been regarded as reflecting the views of the German foreign office. An article in that journal advocated a tariff understanding with Russia to enable the two powers to act jointly against the United States. It declared, in effect, that as matters stand for Europe today the struggle for existence demands that the exceptional position of the United States be abolished. The United States, it added, is a most dangerous competitor for Germany, particularly in iron manufacture and hardware; Germany's tariff must be arranged accordingly, and an understanding with Russia offers ways and means to compel the United States to adapt itself to Europe's tariff system, a result from which German agriculture would by no means suffer disadvantage. One rumor in question took the specific form that negotiations were in progress between Germany and Austria looking to the formation of a European commercial league against the United States.

This latter rumor is denied in government circles at Berlin, where, indeed, it is declared to be impracticable owing to the diversities of race and commercial interests. The United States ambassador and the consul general at Berlin declare that they have not heard of any such negotiations, and they regard the whole proposition as chimerical. Still, it is interesting to notice that, though there is little or no evidence that the supposed Austro-German alliance has received any official support, the rumors regarding it have attracted no little attention on the continent and in the United Kingdom. It is suggested in some quarters that the dread of American competition is being employed to bring the German agrarians into line on the canal bill, and to emphasize the profitableness of a commercial friendship between Germany and Russia. A late rumor bearing on the matter is found in a report cabled from Prague, in Bohemia, to the effect that at a meeting of Bohemian manufacturers, held at that city, it was resolved to initiate a movement for the summoning of all European chambers of commerce with a view to considering measures of defence against American competition. This has been denied, but another rumor has since gained currency, according to which a meeting is shortly to be held at Basel, in Switzerland, at which German, Austrian and Swiss manufacturers will arrange a plan for boycotting American products.

It is the general opinion, however, that such a movement would not commend itself to the commercial classes in Germany, and this is important because Germany would be the controlling factor in any such combination as has been imagined.—Bradstreets.

TRIALS OF BRITISH MEDITERRANEAN SQUADRON.

An official report giving results of the four-fifths power run of the vessels of the British Mediterranean squadron last fall has just been given out. The showing is certainly of an extraordinary kind. The trial was over a course six miles east of Gibraltar to six miles north of Cape Figari (Sardinia), a distance of 788 miles. The results were:

	Coal expended on trial, tons.	Time occupied on trial. H	M.	Average speed per hour, knots.
Ocean	518	46	54	16.80
Isis	264	47	12	16.70
Dido	303	48	30	16.25
Renown	354	49	6	16.03
Venus	330	49	16	16.00
Caesar	406	52	30	15.00
Victorious	455	52	36	14.98
Royal Sovereign	385	54	18	14.51
Royal Oak	509	55	10	14.30
Illustrious	470	55	20	14.25
Ramillies	337	55	22	14.22

It has been decided to hold the next annual meeting of the National Board of Steam Navigation in New York City, Sept. 3, at such place as may be selected by the secretary, Mr. Boyer.

HYDRAULIC JACKS.

The Watson-Stillman Co. of 204-210 Forty-third street, New York, manufacturers of hydraulic machinery, tools and supplies, and who make a large number of tools specially suited to ship yard and marine engineering work, have of late introduced several hydraulic jacks of

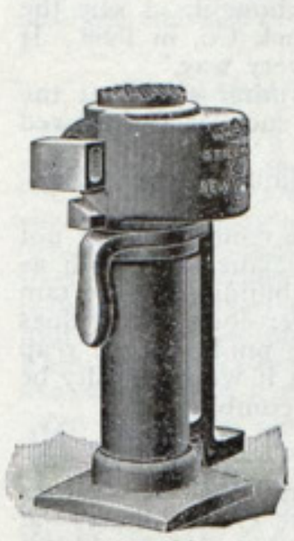


Fig. 1.

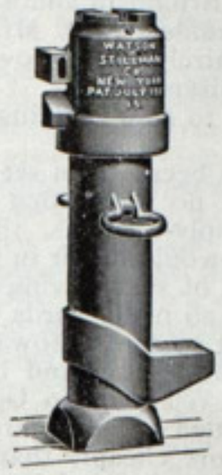


Fig. 2.

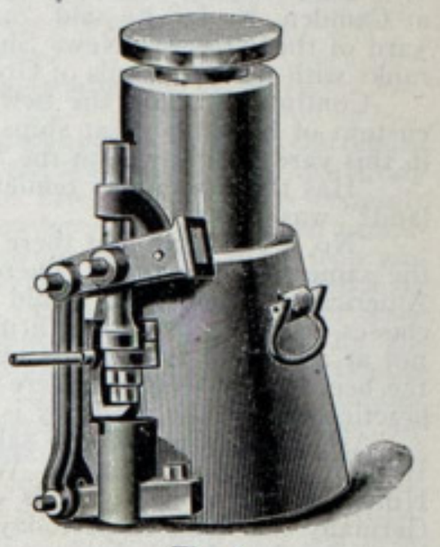


Fig. 3.

improved design to which they are directing special attention. The type of jack shown in Fig. 1 has been found a very convenient tool in all machine shops building heavy machinery, as it is so light in weight (46 lbs.) and so small in size that it can be carried easily in the tool boxes of machine and engine erecting gangs. The toe of the jack is only 1¼ in. from the ground and can be turned to any angle to the operating lever. The jack will operate in a horizontal position as well as vertical. It has a convenient handle. It will raise 5 in. with weight on head, or 4 in. on the claw, which for blocking purposes is sufficient for using 3 in. and 4 in. blocking. The total height of jack is only 13 in. For the manufacture of this jack the company has made a large number of special tools, so as to put it on the market at a very low figure.

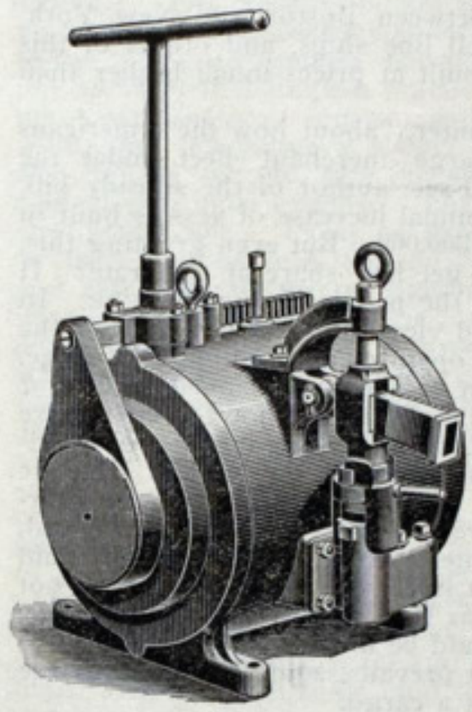


Fig. 4.

The jack shown in Fig. 2 is to be used when there is not room enough to get the head of the jack under the work, and is the style generally used for moving engines, boilers, machinery, etc.

Fig. 3 is an illustration of a tool that has been added to the Watson-Stillman Co.'s heavy jacks to fill the call for something cheaper than the type having two complete rack and pinion pumps, and to give more freedom of working position than is possible when the jack has to be set so that two pumps can be operated. The pump is the same that has for some years been in use on their well-known Vreeland jack, in which the small piston works inside of a larger one, and a latching clutch operating on the larger one throws it in or out of action. The large piston will exert a pressure one-third that of the smaller, and has a movement three times faster.

The tool shown in Fig 4 is of 200 ton size. The pump in this case is similar in action to that shown in Fig. 3, but differs in detail because of conditions of attachment to the jack. The speed of the jack is changed three times greater, and its power to one-third the maximum power by the action of throwing the clutch so that the large piston is placed in operation.

The last and largest of the illustrations shows a modification of the company's independent pump hydraulic jack, designed for pressing back furnace crowns which have dropped down or become misshapen.

A wood cap and base to suit the shape of the crown is made by the user and placed on top of the ram and under the base of the cylinder. The ram is operated by a double plunger independent pump, which is connected to the jack by a flexible copper tube of sufficient length to place the pump outside of the furnace, thereby being very accessible to the operator, and also permitting the crowns to be heated if necessary. If a bar of round iron can be placed lengthwise through the furnace and held in position by attaching it on the outside to the flues, the jack can then be shifted about the furnace by sliding it along the bar hanging from the swivel eye bolt shown on the side of the jack.

INTERVIEW WITH AN ENGLISH SHIP BUILDER.

Mr. George B. Hunter, chairman of the ship building firm of C. S. Swan & Hunter, Ltd., Wallsend-on-Tyne, England, is at present in the United States. In a recent interview in Boston he spoke upon ship building in general.

"I am hoping to see the plant of the New York Ship Building Co. at Camden, N. J.," he said, "as I have heard much about it. I saw the yard of the Newport News Ship Building & Dry Dock Co. in 1899. It ranks with the best yards of Great Britain in almost every way."

Continuing about the new Camden yard, Mr. Hunter said that the custom of building great ships entirely under cover, such as is followed in this yard, is followed at the Wallsend yard.

"Has there been any tendency to ship building combinations in England?" was asked.

"No, I can't say that there has been. You see the conditions are not the same there as here. There is no doubt that specialization, such as American combination would implv—that is, the building of certain classes of vessels by certain firms—would result in lower costs, but it does not at all follow that in the event of such saving the public would reap the benefit. In England there are so many yards that it would hardly be practicable, and the tendency is not so strong toward combinations."

As to the effect of the sale of the Leyland line to Americans, Mr. Hunter would say nothing. With reference to German competition Mr. Hunter said that Germany is entitled to her share, and that he believes Germany can build ships today more cheaply than the United States—at least, she does build them more cheaply—and is therefore better able to compete with England. Mr. Hunter said that our builders of lake and coasting vessels have attained a very high standard, but in ocean tonnage, meaning transatlantic vessels, the English builders do not consider that we have yet come up to their standards. He expressed great admiration for the finer ships on the great lakes and for our coasting steamers, such as the Metropolitan liners, which run between Boston and New York, and the Morgan line freighters, Cromwell line ships, and others of this class. Our ocean tonnage, however, is built at prices much higher than on the other side.

"I have been thinking," said Mr. Hunter, "about how the Americans are to achieve their desire to have a large merchant fleet under the American flag. I am told that Senator Frye, author of the subsidy bill, contemplated as a result of this bill an annual increase of vessels built in American yards for American register of 300,000. But even granting this, how long would it take for America to get her share at that rate? It would not be effective enough to satisfy the people, I snould think. In my belief—and it may seem an interested view, but I doubt that—if the American people would hold the registry open for any unlimited tonnage, provided that it was owned by American capital and manned wholly or in part by American seamen, although in England we don't even require that the crew should be British, it must result in such an increase of building here, as well as ship owning, as would astonish the world. The one thing which prevents American builders from competing with the English as regards cost is that they don't have to. They could if they would, but they won't. Why, I have heard an American ship builder say he could build a ship as cheaply as we can, but that in America the builders are not satisfied with the same margin of profit as the English builder will take. The country needs more ships than it would be likely to get as a result of a subsidy. In France, where this system prevails, some of the ships are run for the bounty alone, and sail without a cargo.

"Mr. Charles H. Cramp wrote an article for the London Daily Mail in which he said that in effect the English builders are subsidized, and that this was one reason why the American yards cannot compete with the British. I don't see where he gets his authority for this, for it is utterly false. He said that the British admiralty pays this subsidy in the form of the large prices which it pays for vessels for the British navy. The fact is that government ship building is the least of the work done, in many cases; that the British war vessels have been built frequently at a loss to the contractor, and that the builders have had, on several occasions, to appeal to the government for funds to get through with the work. No assistance, absolutely none, has been given British builders by the government, and the owners who have received subsidies have received payment purely for value returned. That article could have been answered very effectively. It seemed to be intended for circulation in America."

British tonnage is still on the increase, Mr. Hunter said, although the years 1899 and 1900 were maximum years On the whole, the British yards are very well employed at the present time.

UNITED STATES MERCANTILE MARINE.

(From Syren & Shipping, London.)

"Today the American makes the circuit of the globe. He sails into the harbors of Europe, of Asia, of Africa and South America, amidst the abundant shipping which fills those ports. He passes upon the different seas the argosies of commerce, carrying the products of his own and other countries. The flags of all nations except one fly from the mastheads of these steamers. He sees nowhere the stars and stripes. He finds the peoples and the merchants of foreign lands familiar with every emblem but our own. If he wishes to address a letter home it goes from South America through Liverpool; from China through London; from the east through the mails, and under the flag, of every country but his own."

In these impassioned words did Mr. Chauncey Depew address the United States senate on the subject of the ship subsidy bill, and he further argued that with the establishment of the measure five years would show a wonderful change in the relations of the United States to ocean transportation. "We can," he concluded in his eloquent peroration, "again proudly boast that our ships are upon every sea; our flag in every port; and the name and fame of our country respected by all nations; and that the products and the goods of the United States are in successful competition in every market of the world with our rivals in production, trade and manufactures." After listening to such fervid oratory as this it is hardly necessary to remark that there was applause in the senate and the galleries. Unfortunately for British ship owners, the views so eloquently enunciated by Senator Depew find favor with a very considerable portion of the population of the United States, and it is quite possible that the shipping subsidy bill, authorizing the expenditure of $9,000,000 a year to foster an American mercantile marine, may become law. Looking back at the past history of the United States, it is not difficult to understand the desire to possess an effective merchant fleet. As far back as the year 1807, when the population of the North American republic was 7,000,000, the tonnage registered for the foreign trade was greater than it is at present, when the population numbers over 77,000,000. Half-a-century ago the United States was first among the maritime nations, and was also the principal ship building country. Even as far back as 1828, American bottoms carried 91 per cent. of the foreign commerce of the North American republic, against a modest 8 per cent. in 1900. But in the days when American shipping flourished there were tonnage charges in favor of American vessels, and discriminating duties for goods carried in American bottoms. The splendid wooden clipper ship is now a mere memory of the past, though, after British and other vessels were less heavily handicapped in their competition with those under the stars and stripes, the American wood-built merchant fleets more than held their own. Then to aid this reduced customs handicap came the advent of the iron ship. The adoption of this ship building material gave to Great Britain all the advantages of cheap material, labor and dock facilities, and the marine insurance companies assisted to kill the wooden vessel by discriminating in favor of her iron sister. Then the citizens of the United States insisted on substantial aid being afforded to American enterprise, with the view of supplying a rival to the Cunard company. The famous, but unfortunate, Collins line was the outcome. This fleet received a heavy subsidy in the way of mail contracts. The American story of the failure of this line hardly coincides with that generally accepted on this side of the Atlantic. According to the authority we have quoted from, the Collins line successfully competed with the subsidized lines of Great Britain. They soon in competition brought freight rates one-third below the subsidized English Cunard line, which before monopolized the business. But congress yielded to the cry of free trade—to the literary campaign of the foreign ship owners and to the prejudices which were aroused against the fostering by the government of any industry. The subsidy or mail advantages were withdrawn; the Collins line went into bankruptcy; its ships were sold; and the United States folded its flag and retired from the sea. This is the American version of the matter. The English one, however, is that the competition which led to the reduction of rates was altogether unremunerative, and that this, combined with the misfortunes of the vessels themselves, led to the failure of the line.

But this is now ancient history; the question before the American public is how to resuscitate the long-fled glories of their mercantile marine. A policy of free ships is not palatable, because it would not encourage ship building and the steel trades. The remedy lies, according to the American mind, in subsidies. Foreign nations pay, the United States senate has been informed, $26,000,000 in merchant marine bounties, against $1,000,000 paid to United States vessels. The bulk of this latter subsidy goes, of course, to the fleet of the International Navigation Co. and these four vessels, on the authority of Mr. Chauncey Depew, are, in spite of the assistance of $840,000, run at a loss. Thus the problem before American legislators is no easy one. They naturally want a share of the $26,000,000 paid for the sea carriage of American produce but how they will secure it is by no means clear.

A FLEET OF SEVEN-MASTED STEEL SCHOONERS.

Several of the leading ship building concerns on the Atlantic coast are preparing bids for the construction of a seven-masted steel schooner, destined to be the largest and greatest cargo carrying craft of that type ever put afloat. The vessel is the first of a fleet of seven which will be constructed by a syndicate of which Capt. J. G. Crowley, brother of the Capt. Crowley of the six-master George W. Wells of Taunton, Mass., is the head. The craft will cost when ready for sea about $250,000. About twenty persons have subscribed funds sufficient for the construction of the vessel. B. B. Crowninshield, naval architect of Boston, is the designer and also a shareholder, as are Capt. Crowley, Thomas W. Lawson and every member of his family, and others in Boston. In point of size the schooner will be the largest sailing craft ever built in this country, and it is expected that her earnings as a cargo carrier will be large. Her length on deck will be 395 ft.; on her keel, 333 ft., and at her load water line, 370 ft. The beam will be 50 ft. at the widest point and the depth of hold 30 ft. The vessel will draw 26 ft. of water when loaded to her limit and will displace 11,600 tons, or about the same as a modern battleship. Her gross tonnage is estimated at 6,000 tons, or 1,000 more than the six-masters George W. Wells and Eleanor A. Percy.

The spread of canvas will not be anything great, considering the enormous size of the craft, but her sails will be of larger total area than ever hoisted by a sailing vessel. The seven masts will be built of steel in the same manner as are the hollow metal spars for the modern cup defenders, and solid wooden topmasts will be set in the head of each. The height of each mast with its connecting topmast will be 150 ft. above decks and the rigging to support these tall sticks will be of enormous size and great strength. No name has been selected for the last or seventh mast as yet. The names of the six running aft, are: Fore, main, mizzen, spanker, jigger and driver.

As the construction of a vessel of such great size will require a combination of great strength and not too great weight, the entire craft will be built of steel. Not a bit of wood will be used except for the cabin fittings and for sheathing the upper deck. The plating, beams, stringers and decks will be composed entirely of steel and even the three low houses on deck will be built of metal. The thickness of the steel plates for the sides of the hull will vary from ½ to nearly 1 in. thickness. The topsides or shear strake will be the thickest; down the sides and on the bottom the steel will measure ½ in. through, while the bilges will be ¾ in. thick. On either bilge for about half the length of the vessel, steel bilge keels, firmly secured by angle irons, will prevent the craft from rolling too much. The frames will be of steel channel bars, 9 in. deep and longitudinal stringers will be put in at frequent intervals to distribute the strain. There will be three decks, but the lower one will not be plated, the beams and stringers being left open to allow the stowing of cargo to better advantage. On the upper or poop deck, running the entire length of the vessel, will be three houses. In the forward one will be the forecastle, engine and boiler rooms. The galley house will be built pretty well aft, and further astern will be another engine house. The vessel will be steered by steam, steam-heated, and will have electric lights. A double bottom, 5 ft. deep amidships and running the entire length of the keel, will permit the use of water for ballast when sailing light.

OIL TANK SHIPS.

The first of the large iron tank ships launched by the Standard Oil Co. was aptly named the Maverick, for it was destined to wanderings as great as those of an unclaimed Texas steer. After knocking around the Seven Seas it was burned with its cargo of oil in the harbor of Halifax and sunk; then fished out, weirdly twisted and warped by heat and water, rebuilt and recommissioned. When the war with Spain was declared, it accompanied Sampson's fleet all through the war as a water supply ship for both sailors and troops in transit. When the war was over it was promptly returned to coast oil trade, where it is now doing business as usual. Its career may be taken as typical, for there is no other vessel afloat that encounters so many adventures and misadventures as the tank ship, and none other would survive half of them.

Tank ships, widely scattered over the oceans, have done great service to shipping in the way of towing disabled vessels to port and rescuing crews from wrecks. They are the stanchest ships of the seas, because of their division into water-tight compartments, which are always kept closed. Several compartments may be damaged by collision or otherwise and the steamship will still keep afloat and steam to port. The tank ship Beacon Light once ran on an iceberg and tore out a considerable part of her bottom, but continued on her voyage to port. Several of these ships have been ashore, but by pumping out compartments were able to draw away and proceed. The tank ship Energie ran on a rock off the Lizard, doing much damage, but got off by emptying some compartments, arriving in Bremen two days late.

But though it will win through many perils of water, the tank ship falls victim to fire, notwithstanding the greatest precautions of cofferdams, or double bulkheads, which are filled with water, and despite constant watchfulness on board. The case of the Maverick at Halifax is characteristic. At a time when oil was being pumped into the ship and some one had carelessly left open the door leading between decks, a pipe burst. Before the pump could be stopped the oil was forced through the open door into the fire room. An additional cargo of case oil, unusual in vessels of this class, hampered prompt use of fire apparatus. The Maverick was sunk in the harbor as a last resort. The total bill for the episode was $150,000.

The tank ship Weehawken was once proceeding down the Delaware river, when she ran on a rock, injuring her cofferdam and permitting her cargo to run into her fire room. When the fire was over there was no Weehawken left; only old iron. The tank ship Attila went ashore at Nodre Renner, Denmark. The oil reaching the fire room, soon furnished a grand blaze. After she had been burning ten days a hole was blown in her with dynamite, causing her boiler room to fill with water. A salvage ship then approached and began flooding her burning holds, when a tremendous explosion took place, involving the whole afterpart of the vessel and wounding many of the salvors, the remainder escaping by jumping overboard. The fire then raged furiously. It was only subdued by exploding more dynamite and flooding the entire vessel with water. The ship was then tightened, pumped out, towed to Copenhagen and repaired. She is still in service.

The tank ship Minister Maybach left New York in December, 1898, on her maiden voyage, laden with 1,750,000 gallons of oil and a crew of thirty-two men. She was never heard of again. It was the memorable January when there were heavy gales in which at least ten steamships were lost. She may have shared their fate or she may have blown up, as many believe.

One tank ship, the General Knox, laden with case oil, burned at the foot of Wall street, New York, affording a splendid spectacle for financiers. On the beach at Fire island, New York harbor, may still be seen the wreck of the tank Gluckauf, now half buried in sand. She was driven ashore there and the best efforts of her crew could not bring her off from the shifting bottom. One great danger to tank ships appears after the cargo has been discharged, when gas generates in the empty tanks. Any kind of open flame results in an explosion. Electric hand lamps are now generally used. It is the gases generated by the oil, not the oil itself, which explode. Prior to 1890 the tank ships had their engines far aft. Then an attempt was made to place the engines amidships with tanks at both ends, causing much comment and apprehension on the part of the marine underwriters. There were devices arranged, certain steam jets, to blow the gases from the oil out of the shaft alley. The several vessels constructed in this manner were soon condemned, and builders returned to the former method of placing the engines aft and the tanks forward of them.

There has always been much difficulty in keeping the tank ships tight, as the oil eats the rivets. At present the underwriters have nothing to do with the oil craft, the owners insuring their own vessels. A tank ship may be described as a steel marine Goliath, divided into steel-walled, air-tight, oil-tight compartments located forward of the motor section and living rooms. It is loaded and unloaded by pumping the oil direct to and fro between the wharf reservoirs and the compartments of the ships. Each compartment holds on the average 140,000 gallons of oil, and each tank ship has from twelve to twenty compartments. Aft of the compartments are the engine and boiler rooms which the oil can reach only in case of extraordinary wrecks. Aft of the motor power are the living rooms. A spirit of automatism prevails on the tank ship, so regulating the flow of oil that the compartments are filled without wasting a drop. The tank ship is loaded to the shell, from keel to amidships deck, except that, far forward, is a dry compartment for other freight.

The highest type of tank steamships is found in the Tuscarora class, carrying 2,500,000 gallons of oil in bulk. The twenty oil compartments are connected by a complete system of pipes with the pump rooms, where are powerful duplex pumps for handling the cargo, with connections to all the sea valves. About six hours is sufficient to discharge the cargo. The 10-in. mains have bell-mouth suction connections fitted with independent valves tested for an oil pressure of 400 lbs. to the square inch, and designed to stand the action of salt water and naphtha. They are operated from the upper deck by means of valve rods fitted with connections. The square iron boxes one sees on the deck of tank ships are expansion hatches over the tanks, in which the oil rises and falls with the barometer, or, as it is made to expand or contract, by the atmosphere.

There are about 200 tank ships engaged in the transport of American oil, most of them sailing from New York, Philadelphia and Baltimore. In addition, 300 oil cask vessels are engaged. This great fleet of 500 vessels handled in 1900 the enormous total of one billion and a half gallons of oil, mostly refined, a fraction of it, 134,000 000 gallons, being crude oil. Many of these ships carry other cargo on the return trips. Four tank ships which left New York last year loaded with grain arrived at their destination without a trace of the odor of petroleum and delivered their cargoes in perfect condition. One tank ship takes oil in bulk from Philadelphia to Calcutta, there loads with coal for Singapore, where it is cleaned, and takes on spices and chemicals for New York.

ENGLISH IRON MASTERS URGED TO WAKE UP.

The outspoken remarks of a Cleveland engineer, William Garrett of rod mill fame, on the subject of "American and British Rolling Mill Practice" at the recent meeting of the Iron and Steel Institute, has certainly stirred up the English press. The discussion has, of course, given prominence to the broader issue of competition from America in all iron and steel lines. This was to be expected, as Mr. Garrett's criticisms of British rolling mill practice were along that line. Some of the English trade journals confess disappointment at the tone of answers made by the English iron masters to Mr. Garrett's remarks. "One would almost have imagined whilst listening to the speeches," says Engineering of London, "that the author had brought gratuitous accusations of discreditable conduct against the steel makers of Great Britain, being, perhaps, prompted by a desire to score an American verbal triumph over British manufacturers. We by no means take this view. We are convinced that his paper was as friendly as it was able and outspoken." Dismissing in a few paragraphs the detail attending the discussing of rolling mill practice particularly, the same journal says:

"We may certainly expect that unless British rolling mills, steel furnaces, and blast furnaces—in short, the whole practice of iron and steel making—are equal to those of our competitors, we shall be worsted in the struggle. The question is, are we falling behind in this respect? There was a tone of complacency about the discussion that would lead a stranger to the subject to suppose that all is well with us. It is not so much, said one speaker, that English practice is behind that of America, as it is that the Americans have superior natural advantages. Another steel manager would not exchange a slower geared mill for the best in America, although we were not sure this statement was not qualified by a consideration of additional expense. That is the rock on which so many of our steel plants split. 'I may be wrong,' said Mr. Garrett, 'but I will venture to make the assertion that during the past ten years all the British iron and steel manufacturers together, did not spend as much money on improvements as the Carnegie Steel Co. did in two years.' It is a startling announcement. Whether indisputably true or not, can any steel maker, who has lately visited Pittsburg, say it is sufficiently wild not to be a damning indictment against the once paramount British enterprise? This is a question we do not attempt to answer; but it should be answered, and that authoritatively. Our experience of the Carnegie company is sufficient to assure us—unless consolidation has wrought an entire change—that the officers of the company would afford full facilities for information on this point. It is idle to bring forward isolated instances of steel being shipped to America, such as a thousand tons of cotton ties—fluctuations in demand will always produce such effects—or to say that improvements common in America were suggested, or even introduced, in this country years ago; the dominating condition is, are British blast furnaces, steel mills, and furnaces on the whole, equal to those of America? If they are, we need not be ashamed, although, perhaps, the country of Bessemer, the birthplace of the modern steel industry, might have been expected to maintain its lead in the race, rather than be content with a dead heat. Both American and German steel production exceed our own.

"It was with regret that we heard an excuse brought forward more than once during the discussion for the lack of improvement in British steel factories. It was assumed that because in America an old factory and an old plant did not exist, that therefore an American steel master was in a better position to spend money on advanced plant than a British steel maker, who had been long in the trade. The contention puts forward one of the most pernicious heresies of company finance. If it will pay a new corporation having no established business or connection to invest large sums in advanced machinery, it surely ought still better to pay a company with an old-established list of customers. 'But,' it is said, 'we should have to throw away half our existing plant.' Exactly! That is just what should be done, and if a sufficient amount were written off for depreciation—taking into account not only plant wearing out but also its becoming obsolete through the march of invention—then the difficulty would not arise. Whether it is the fault of the managing directors or shareholders we need not inquire, but the tendency to divide profits up to the hilt is far too great. 'In America,' it was said by an English speaker, 'they do not hesitate to abandon existing plant,' and he instanced one case in which $600,000 had been spent for the production of tin plate bars, and the plant had been abandoned simply because it had been superseded. The same speaker had quite lately visited works where a plant upon American lines was being put down, although obsolete in America. It had taken us five or seven years to appreciate the value of the improvements, and during that time they had grown quite out of date in the land where they were originated."

The former Spanish cruiser Reina Mercedes is to be fitted as a training ship for landsmen. When the work of repairing her has been completed she will be placed in commission without further delay. The Reina Mercedes was sunk by the Spaniards in Santiago harbor on July 4, 1898, to prevent Sampson's ships from entering. After the war she was raised and taken to Norfolk and then to Portsmouth, N. H., where she is now. It was originally intended to house over the vessel and to use her as a receiving ship, but an examination showed that she could be put in condition for sea service. All the machinery will be new.

"This port," says a Sandusky dispatch, "has not been slow in the matter of loading ships since navigation opened this spring. The steamer Bielman reached the Baltimore & Ohio coal dock in time to begin loading early Thursday morning last. At 8:30 a. m. the next day she had passed Detroit on her way up the lakes with a cargo of about 2,700 tons of coal."

HISTORY OF THE AMERICA'S CUP.

Syren and Shipping of London, England, recounts in a very interesting way the history of the struggle for the America's cup. Now that both contestants for this year's race have been launched, the story, which follows, is worthy of reproduction:

It was on Aug. 22, 1851, that the schooner America showed the best British yachts the way round the Isle of Wight, and won from her eighteen competitors a £500 cup. That was half a century ago, and still the palm for fast sailing yachts must be awarded to our cousins across the pond, despite the plucky attempts of British yachtsmen to build speedier boats. The evident superiority of the America led English yachtsmen to copy her more salient features. The old type of British yacht, designed on the cod's head and mackeral tail system, was replaced by a longer and finer bowed craft, with more raking masts, while the sails—to emulate the flatness of the America's canvas—were laced to the boom. Still, for all that, there was no great similarity between the types of swift sailing pleasure craft in vogue on either side of the Atlantic. This disparity between the English and American yacht was, perhaps, never so strongly marked as in 1885 and 1886, when the English boats Genesta and Galatea failed to regain the cup carried away by the schooner America in 1851. These vessels were typical cutters, the ratio of beam to length in the case of the Galatea being 1 to 5 2-3. Her competitor was the Mayflower, and in each vessel it was possible to trace what might be termed the process of evolution, whereby the inshore and usually calm waters off the eastern seaboard of the United States had tended to produce a vessel of the skimming dish type, that is of great beam and little depth. English yachtsmen, on the other hand, had evolved a deeper and narrower vessel, capable of making good weather of it in the turbulent seas and strong winds experienced in the seaways round our shores. Thus, when the Mayflower and the Galatea crossed the starting line, the two types were clearly on their trial. The differing dimensions of each boat are extremely interesting, especially when they are compared with the Shamrock II and the Constitution, which are to do battle in the present autumn:

	MAYFLOWER.	GALATEA.
Length, over all	100 ft.	102.6 ft.
Length, on water-line	85 ft. 7 in.	86.8 ft.
Beam	23 ft. 6 in.	15 ft.
Beam at water-line	23 ft. 3 in.	15 ft.
Draught	10 ft.	13½ ft.
Displacement	128 tons	157.6 tons
Mast, deck to hounds	63 ft.	53 ft.
Topmast	48 ft.	51 ft.
Boom	80 ft.	73 ft.
Gaff	50 ft.	46 ft.
Bowsprit outboard	38 ft.	37½ ft.
Spinnaker boom	67 ft.	67 ft.
Ballast	50 tons	80 tons

In the first race, the Mayflower won by 12 minutes. The first attempt at a second race was frustrated by light winds, and when the race was sailed there was so little wind that the American yacht, though she beat the English cutter by 29 minutes, was within 10 minutes of the 7 hours' limit. This defeat of Lieutenant Henn's boat was a great blow to the yachting cult on this side of the Atlantic, for the challenger was justly deemed an all-round good boat, especially capable of giving a good account of herself in anything like a blow. From this time onward, the English and American type of yacht have approximated, each nation adopting the good points of the other, so far as conservatism and physical conditions of sea and weather would permit. This convergence of types is shown by the fact that the Thistle, though of the same length on the water-line as the Galatea, had a beam of 20 ft. and a much bigger sail-spread. When the Shamrock and the Columbia contested in 1899, the sail areas of the two vessels were approximately equal, that of the Shamrock being 13,491 sq. ft. and of the cup defender 13,135 sq. ft. But even this enormous sail-spread will be eclipsed by the Constitution, and, we presume, by Shamrock II also. Since the race of 1886, the length along the water-line of these international contestants has practically remained the same, and despite this fact, the sail area has increased enormously. The following are the dimensions of the Constitution and it is interesting to compare them with those of the Galatea:

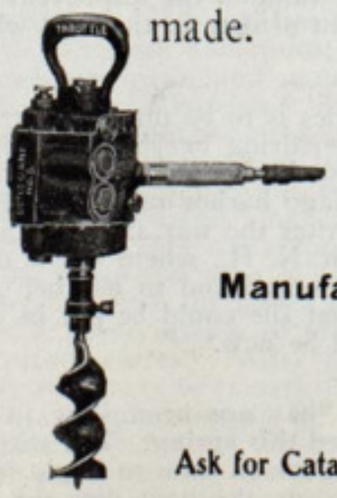
Length, over all	141 ft.
Length, on water-line	89 ft. 10 in.
Beam	23 ft. 5 in.
Draught	20 ft.
Displacement	147 tons
Ballast	75 tons
Mast	108 ft.
Topmast	50 ft.
Boom	108 ft.
Gaff	63 ft.

The sail area of the Constitution is over 14,500 sq. ft., or 1,500 sq. ft. more than that carried by the competitor with the first Shamrock. But, perhaps the fact which best illustrates the lines on which the modern yacht has developed, is shown by a comparison of the sail area of the Galatea with this year's cup defender. The area of the main sail of the latter is greater by close upon 1,500 sq. ft. than the whole suit of plain sails, five in number, carried by the Galatea. Regarding the matter from this point of view, it is simply marvellous how, adhering to the same length of water line and working in the direction of minimizing the wetted surface, that it should be possible to have so increased the sail spread. How does Shamrock II contrast with these measurements? Though at present official figures are not forthcoming it will probably be found that her length, from end of boom to end of bowsprit, will be greater, certainly not less, than that of her rival. So it is with her masting, and this, of course, argues a sail spread as great as her rival's. But when all is said and done, though design of hull may approximate the difference be-

"Little Giant"

Pneumatic Reversible Boring Machine No. 5

Is especially designed for Ship Yards and Dock Work and is capable of drilling in any kind of wood up to three-inches diameter any depth. This machine can be reversed at full speed by simply turning the handle to right or left, withdrawing auger instantly. It is in use in all the United States Naval Yards and a majority of the Ship Yards on the Atlantic and Pacific Coasts; also on the Great Lakes. It is made entirely of steel, will withstand hard service, can be operated in a bath of oil, as the air exhaust does not come in contact with the working parts, and has absolutely no vibration. This machine will do the work of five men and is recognized by the mechanics of the world to be the most convenient and durable air boring machine made.



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tween the American and English type towards the irreducible minimum; though spars and masts may be made of the lightest; and the sail spread may be of the biggest; there is, notwithstanding, a very grave handicap under which an English yacht must ever labor when challenging the possessor of the America's cup. She has to cross the Atlantic in order to meet her rival, and the Atlantic never was, nor ever will be, a respecter of vessels. Shamrock II, as likely as not, may encounter a stiff blow while crossing the pond, and this is a probability which has to be recognized and provided for. Hence she must be more strongly and more heavily built than the home built American yacht, and therefore she will carry weight when she meets the Constitution. The existence of this handicap should not be overlooked, and the fact that it is recognized brings out the pluck of Sir Thomas Lipton into greater relief. The novel weather conditions, too, must tell to some extent against a British crew who can hardly be expected to give as good an account of themselves as when sailing in the Firth of Clyde or the classic vicinity of the Isle of Wight. That Shamrock II will be a great boat, fit to sail in fair weather or foul, goes without saying. Whether, however, it will be fast enough to beat the American yacht is another matter. We hope it will, as well for the honor of British yacht architecture, as for the pluck and public spirit of the challenger.

DRAUGHT OF WATER IN THE RIVERS.

Mr. Joseph Ripley, assistant engineer in charge of the canals at Sault Ste. Marie, says of the draught of water in channels of the St. Mary's river:

"Above the locks the river is at the normal stage, so that there is a clear depth of water in the channels of 21, or more, feet. At the present time the water is 2 in. higher than it was a year ago, and has averaged t' at amount since last January. Below the locks the river is 2 ft. below the normal stage, but is 3 in. higher than it was a year ago this time and has averaged 4 in. higher since January than it was the first five months of last year. There is at least 18 ft. depth of water in the sand and clay cuts and about 20 ft. in the rock cuts. As the total amount of rainfall thus far this year is nearly 2 in. less than the average, it is quite probable that the usual rise of the water in the river will take place and that by next September the water will 12 to 15 in. higher than at the present time."

The section of shoalest water in the connecting rivers of the lake system last season was in the vicinity of Ballard's reef and the narrow channel between Bois Blanc island and Amherstburg, near the mouth of Detroit river, where dredging on a large scale has been under way for several years past. It is now reported from that section that the depth of channel all the way down from Ballard's reef to the mouth of the river is fully equal if not better than it was last year, although the stage of water is about 6 in. lower. The increased depth is, of course, due to progress with the dredging operations. The shoalest spot now between Detroit and Lake Erie is the Lime-Kilns cut. This cut is being widened to 600 ft., and the government engineers have located to the westward of it a channel of 300 ft. width and 13 ft. depth which will shortly be buoyed for light-draught vessels, so as to relieve the situation while the widening of the Lime-Kilns is under way. A contract is to be let this week for widening to 500 ft. the channel between Bois Blanc island and Amherstburg. This channel will, of course, be dredged to the full depth of 21 ft.

A second book of sailing directions for the great lakes has just been issued by the United States hydrographic office. It deals with Lake Michigan, Green bay and the Straits of Mackinaw. It will be remembered that the hydrographic office issued only a short time ago sailing directions for Lake Superior and the St. Mary's river. Books dealing with the other lakes will be issued later and then all will be put into one volume. The advance publications dealing with the different lakes are published at such a low price, however, that there is urgent demand for them. They sell at 30 cents each. It may be several months before all are published. The Lake Michigan book, alike to the one dealing with Lake Superior, contains valuable information regarding the compass, barometer, rules of the road, etc. These publications are for sale at the office of the Marine Review Pub. Co.

In September next another of the new North German Lloyd steamers, the Kronprinz, will be placed in service between Bremen and New York. She is 16 ft. longer than the Kaiser Wilhelm der Grosse, and will be a half knot faster. The keel of the Kaiser Wilhelm II. has been laid. She will be the fastest ship in the world, size considered. She will be 707 ft. long and will have 72 ft. beam. It is arranged to have two promenade decks, one above the other, and above the uppermost promenade deck will be an awning or sun deck for the bridge, chart rooms, officers' rooms and boats. The Kaiser Wilhelm II. will carry 600 first-cabin, 350 second-cabin and 800 steerage passengers.

It was decided, a few days ago, by the navy bureau of construction and repair that in the future vessels would not have a center keel of wood, but in lieu thereof they would be provided with a steel rubbing plate. Such a device will, it is said, reduce the draught of a ship about 3 in. and will greatly facilitate docking. The bureau has ordered that the battleship Massachusetts be placed in dry dock at New York for about two weeks. It has called upon the constructor on duty there to furnish it with a detailed list of the repairs necessary on the ship. The work on the turret of the Kearsarge will take about six weeks.

The Pan-American exposition at Buffalo opens May 1, 1901, and don't forget that the Nickel Plate road is the shortest and most expedient route to Buffalo and will land you directly at the exposition gates. Rates are in effect April 30, 1901, and good going or returning on any of our trio of daily express trains. Write, wire, 'phone, or call on nearest agent. C. A. Asterlin, T. P. A., Ft. Wayne, Ind., or E. A. Akers, C. P. & T. A., Cleveland, O. No. 37 June 1.

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Number of Nautical Miles made each year by Steamships of the Messageries Maritimes Co., Provided with Belleville Generators—Since their Adoption in the Service.

Year.	Australien	Polynésien	Armand Béhic	Ville de la Ciotat	Ernest Simons	Chili	Cordillère	Laos	Indus	Tonkin	Annam	Atlantique
1890	67,728	2,460										
1891	68,247	68,331	204									
1892	68,247	68,403	69,822	23,259								
1893	68,379	68,343	68,286	68,247								
1894	68,439	68,367	68,574	68,439	37,701							
1895	68,673	68,766	68,739	68,808	40,887	28,713						
1896	69,534	92,718	69,696	69,549	62,205	63,153	40,716					
1897	68,250	69,606	92,736	69,555	62,235	76,110	63,357	43,146				
1898	70,938	69,534	69,552	69,597	62 526	63,240	63,240	62,553	63,954	22,707		
1899	69,534	69,615	67,431	90,405	60,246	62,778	62,868	52,344	54,855	44,007	22,884	
1900	69,534	67,494	69,744	69,564	61,719	62,382	62,502	51,471	53,373	62,016	63,066	52,140
Total	757,503	713,637	644,781	597,423	387,519	356,376	292,683	209,514	172,182	128,730	85,950	52,140

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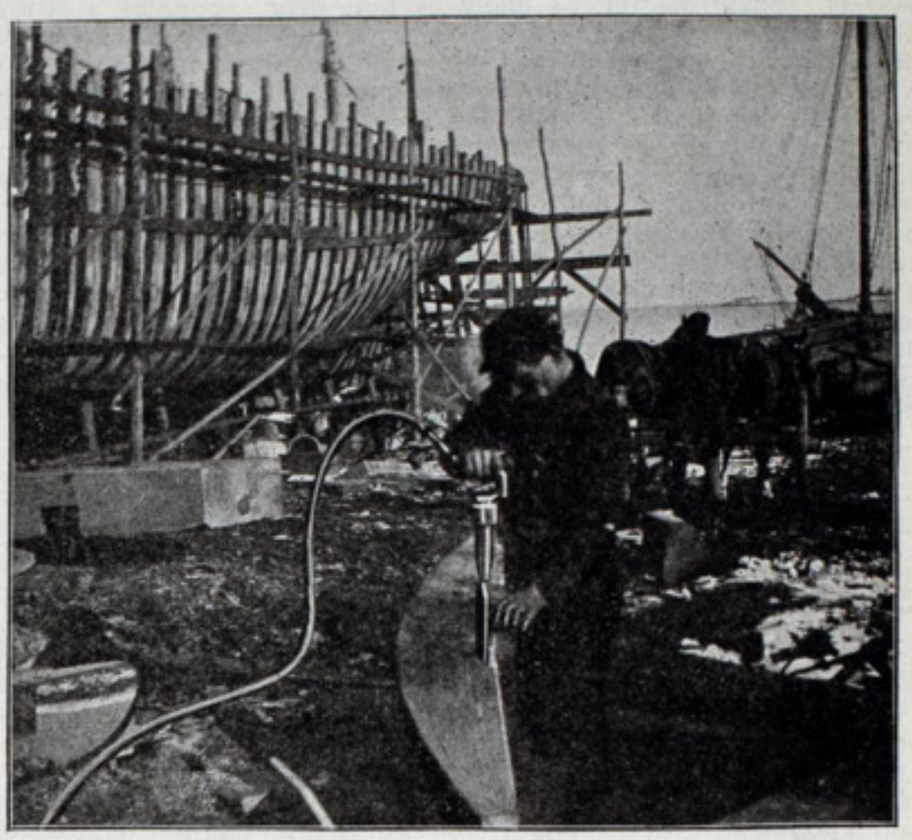
TELEGRAPHIC ADDRESS: BELLEVILLE, SAINT-DENIS-SUR-SEINE.

VARIOUS USES FOR PNEUMATIC TOOLS.

Pneumatic tools are being put to all manner of uses in ship yards. The development of these tools in America for riveting, reaming, chipping, caulking and various other operations in the construction of steel ships has attracted world-wide attention, and now we find them applied to a great variety of work in ship yards where wooden vessels are built, and in the building of docks and other structures involving the use of heavy timber. One of the latest uses is that of chiseling and gouging. This is done by fitting the necessary tools to a pneumatic hammer. One of the illustrations presented herewith shows the "Little Giant" pneumatic hammer, manufactured by the Standard Pneumatic Tool Co. of Chicago, engaged in mortising work in a ship yard. A series of very rapid blows is struck upon the end of the chisel inserted in the hammer, and the chisel is thereby driven rapidly into the timber desired to be mortised or otherwise treated. The work is done much more rapidly and with greater ease to the operator than by the hand method of mallet and hand chisel. For this class of work and all large framing where timbers are used these tools will be found of inestimable value. The Standard Pneumatic Tool Co. has sold quite a number of these tools to ship yards on the Atlantic and Pacific coasts and on the great lakes and the results obtained have surpassed the most sanguine expectations. The Chicago company is quite willing to send on trial one or more devices of this kind to any of the ship builders, builders of docks or other concerns that may have use for them and they bear the expense of carriage, on the understanding that they are not to be kept unless well suited to the work for which they are intended.

Another tool of special value in the building of wooden ships, docks, etc., is the "Little Giant" pneumatic reversible boring machine. It is capable of drilling up to 3 in. diameter and any depth in any kind of wood.



It can be reversed at full speed by simply turning the hammer to right or left, withdrawing the auger instantly. It is made entirely of steel, will withstand hard service, can be operated in a bath of oil, as the air exhaust does not come in contact with the working parts, and has absolutely no vibration. It is claimed for this machine that it will do the work of five men.

The Seaboard Steel Casting Co., Chester, Pa., have been awarded the contract for the hull castings of the mamoth vessels building by the Eastern Ship Building Co., New London, Conn., for the Great Northern Steamship Co. There are said to be thirty pieces all told in the stems, rudders and stern posts. The total weight is about 250 tons and the contract has a valuation of about $50,000.

Pan-American exposition rates to Buffalo are in effect April 30 via the Nickel Plate road at one-and-one-third fare for the round trip, good to return within fifteen days. A rate of one fare for the round trip will be made good going on Tuesdays in May and returning within five days. Write, wire, 'phone or call on nearest agent, or E. A. Akers, C. P. & T. A., Cleveland, O. 47, May 30.

The success, or lack of success, of propeller wheels is largely attributable to the care, or lack of care, in fitting the conditions of each particular case. Especial attention is given that very important subject by the Marine Iron Works, station A, Chicago, resulting in their being in receipt of many orders for propeller wheels within their range of sizes (18 in. to 6 ft.), and in the speed, cruising or towing patterns, as may be required. 6

A New Locomotive Fire-Box Marine Boiler

For sale for immediate shipment. Shell 66 in. diameter. Fire box 84½ in. long, 89 in. high, 64 in. wide. Contains 237 2¼ in. by 17 ft. iron tubes. Steam drum 36 in. diameter, 11 ft. long. Working pressure, 200 lbs. Built to pass government inspection. Detailed specifications on application. The S. Freeman & Sons Mfg. Co., Racine, Wis. tf

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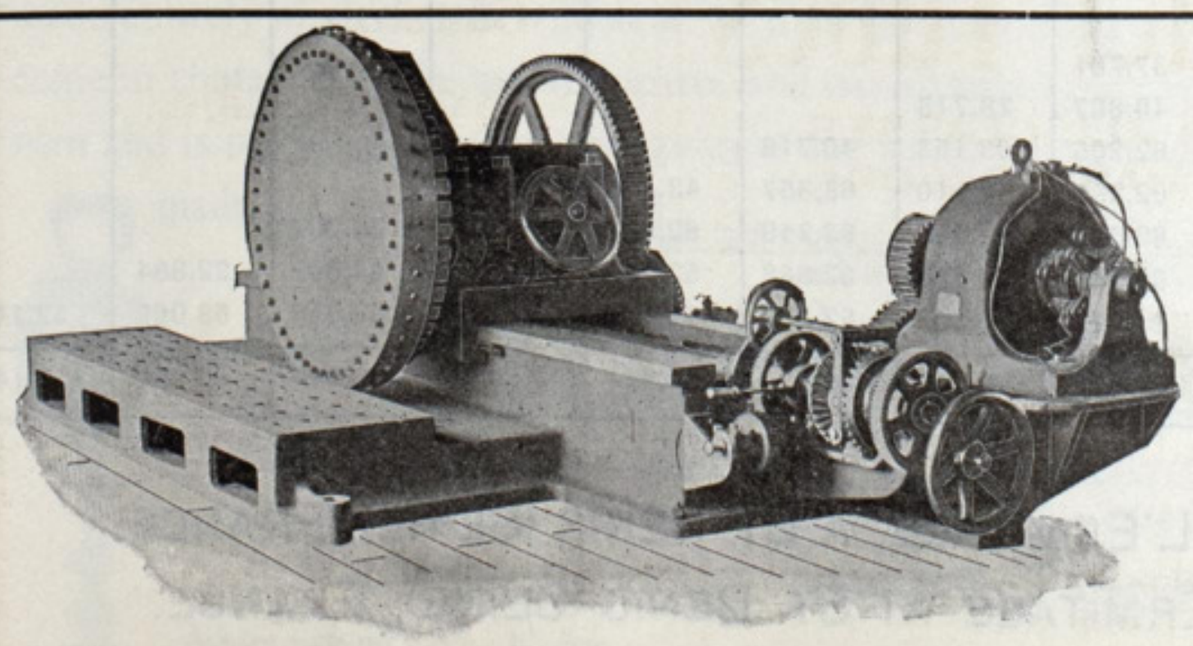

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This machine is in a class of its own.

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FAN BLOWERS IN A MODERN SHIP YARD.

The equipment of the ship building plant of the Fore River Ship & Engine Co. at Quincy Point, Mass., exemplifies in marked degree the varied applications of the fan blower. Draft for its boilers is produced by an induced draft fan drawing the gases directly from the uptake flue and discharging them through a small stack extending only a few feet above the roof. Under the forced system, fan draft is likewise employed for creating the necessary intensity of combustion in the heating furnaces and forges, while the smoke is removed from the forges through hoods communicating with an exhaust fan. All buildings are heated by the hot-blast system, by means of which a fan forces the heated air through distributing pipes and delivers it along the walls and above head level. Notwithstanding the exposed position of the buildings, the first winter has been passed with perfectly uniform internal temperature throughout all of the buildings. The entire equipment of blowers and heating apparatus at these works was installed by the B. F. Sturtevant Co. of Boston, Mass.

A feature of the exhibit of the United States light-house establishment at the Pan-American exposition is the topophone, an instrument intended to assist the mariner in determining the direction of sound in fog, and which was described in the last issue of the Review. It is manufactured by the J. B. Colt Co., Room 7, No. 21 Barclay street, New York. The United States Government has established 393 fog signals, 120 bell buoys, 73 whistling buoys and 44 light-vessels with fog signals on or near the shores of its navigable waters. Other nations have similarly guarded their coasts. Every vessel that floats is required by law to carry some kind of a fog signal. In addition, there are other sounds, such as echoes and breakers, whose direction the mariner needs to know to prevent accident. The topophone has been devised to accomplish just that thing. By its use the mariner can determine the direction of any sound long before it can be heard by the unassisted ear.

Pan-American exposition rates to Buffalo via the Nickel Plate road—Tickets now on sale at all stations, one and one-third fare for round trip, good returning fifteen days. Write, wire, 'phone or call on nearest agent, or E. A. Akers, C. P. & T. A., Cleveland, Ohio. 85, Aug. 1.

New train east via B. & O. R. R.—Leaves Cleveland 11:20 p. m. daily with through sleeper to Pittsburg and observation chair cars to Washington, Baltimore, Philadelphia and New York, giving daylight ride through the mountain scenery. June 30.

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THE LATEST AND BEST STOCKLESS ANCHOR.
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OPEN-HEARTH STEEL CASTINGS OF THE HIGHEST GRADE.
FACILITIES FOR CASTINGS UP TO 80,000 POUNDS WEIGHT.
MACHINE WORK AND PATTERNS FURNISHED WHEN REQUIRED.
RAIL OR WATER DELIVERIES.
CAPACITY, 1500 TONS PER MONTH

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BALANCED COMPOUND MARINE ENGINES carried in stock for immediate delivery—20 to 200 horse power. Full line of patterns for larger sizes and quadruple expansion engines, insuring quick delivery. Highest economy and speed.

NO VIBRATION. Contracts taken for complete plants.

July 25. **WELLS ENGINEERING CO., 136 Liberty St., NEW YORK, N. Y.**

TUG MAURICE W. FOR SALE.

Practically a new boat; 50 ft. over all, 12 ft. beam, 5 ft. draught. Swings a 4-ft. wheel. Machinery built by Sutton Bros. Price, $1,600. cash. L. E. Welch, Mackinaw City, Mich. June 13.

STEAM YACHT (Screw Schooner) FOR SALE.

Dimensions: Over all, 73 ft. 1 in.; water line 63 ft. 7 in.; beam, 12 ft. 3 in. Vertical steeple-compound condensing engines, 10 and 20 by 12 in. Seabury boiler. Accommodations in cabin for four persons. All furnishings complete, ready for cruising. Price, $7,500. Box 2275, Boston, Mass. May 30.

FOR SALE OR CHARTER.

First-class British steamers, of Welland canal dimensions; about 3,250 gross tons capacity, carrying about 2,000 gross tons on 14 ft. (fresh water) draught. Speed 10 knots loaded; easy consumption. Large hatchways. For further particulars address "Charter," The Marine Review Pub. Co., Perry-Payne Bldg., Cleveland, Ohio. May 30.

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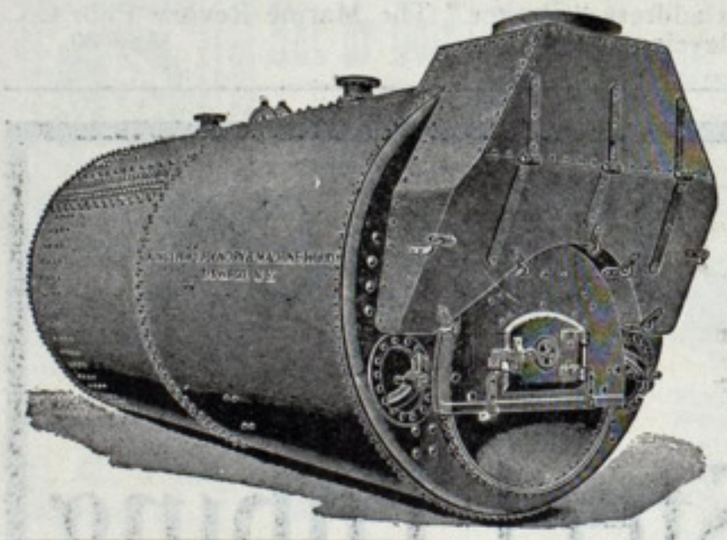

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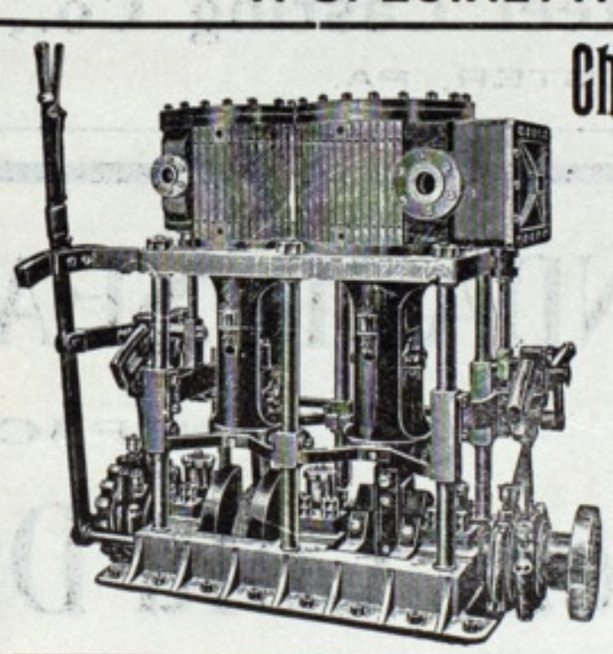

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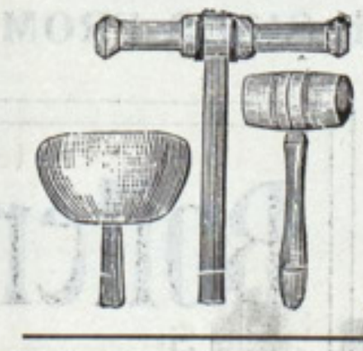

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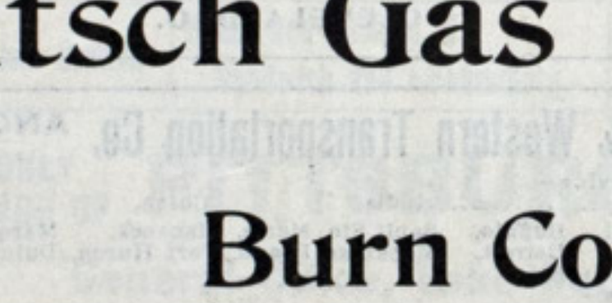

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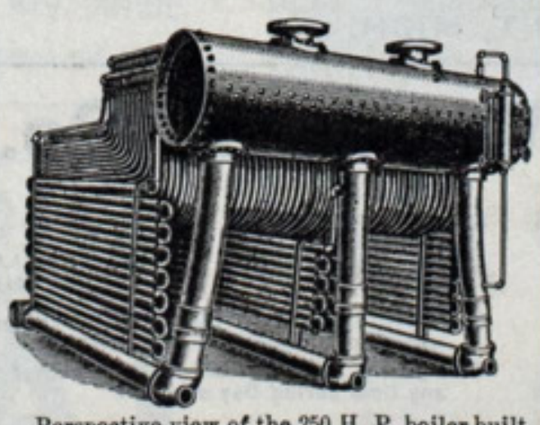

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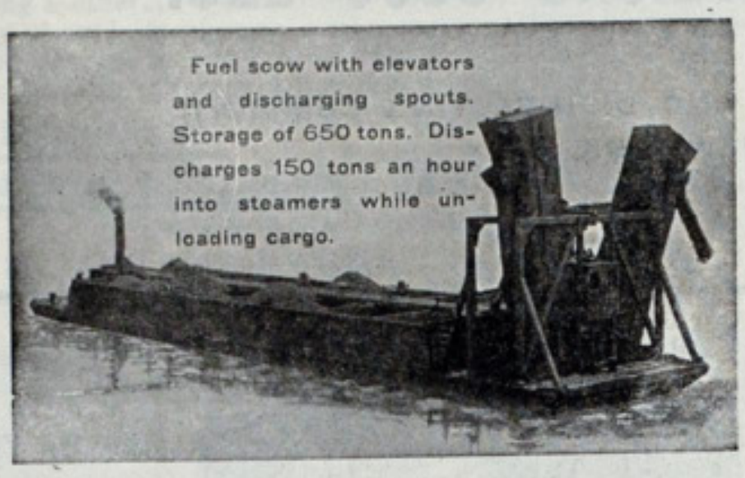

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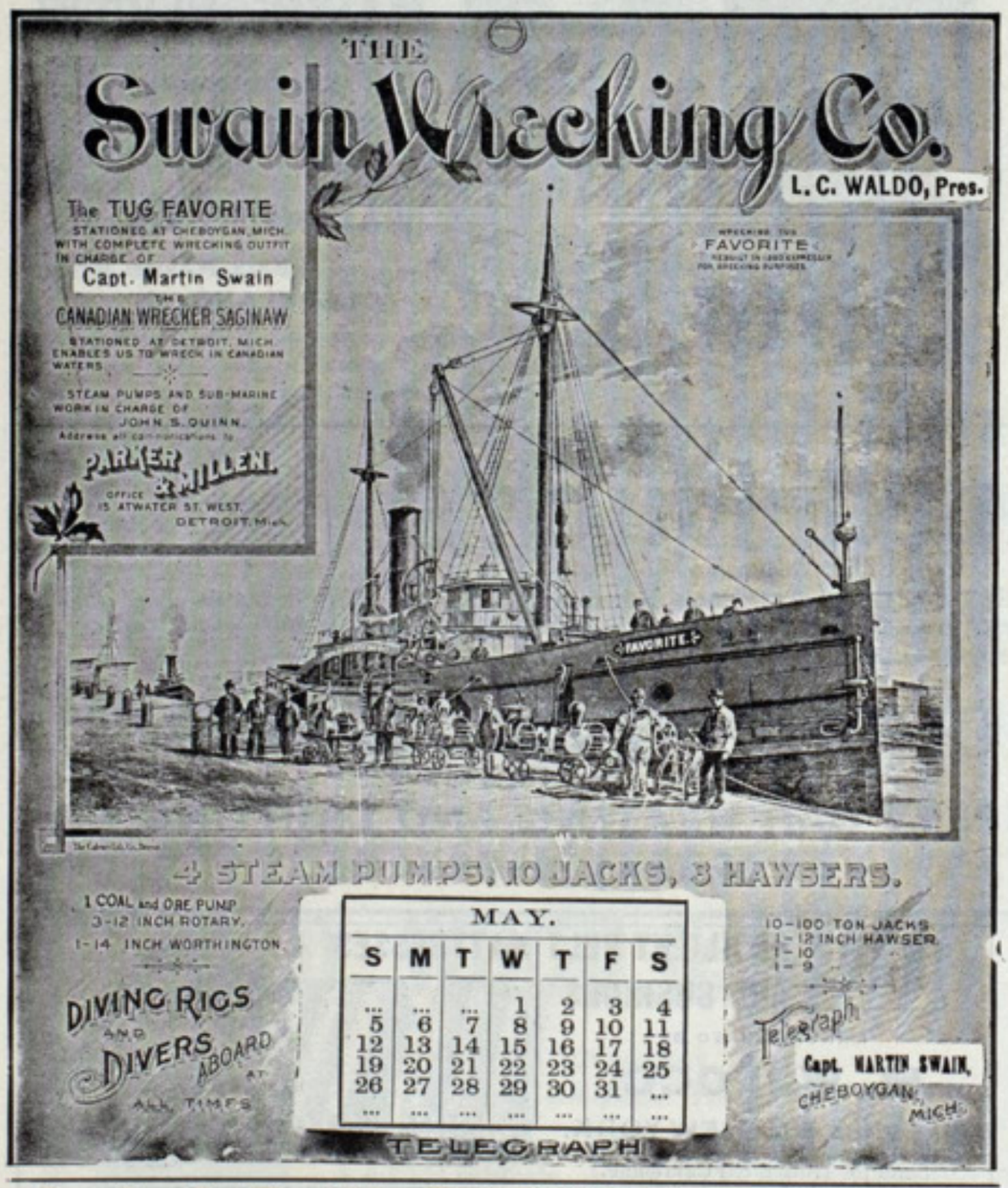

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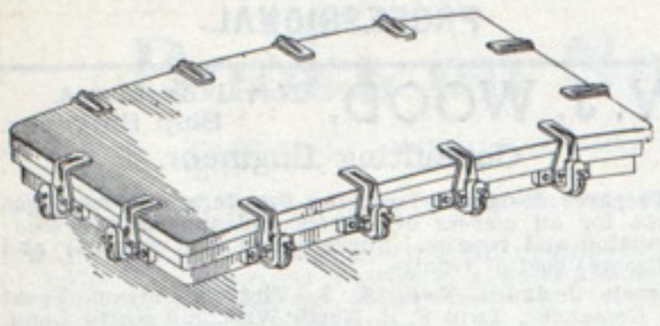

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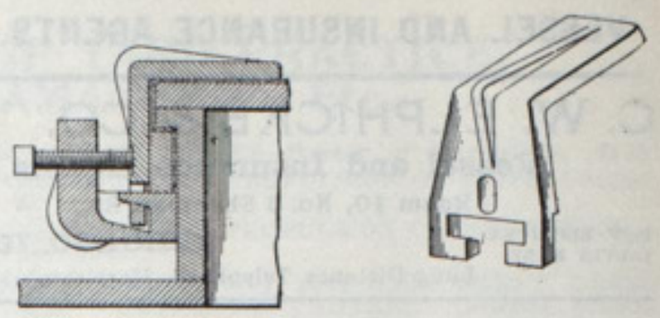

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Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

IGNITERS FOR GAS ENGINES.
Holtzer-Cabot Electric Co.....Brookline, Mass.

INJECTORS.
Crane Co.....Chicago.
Jenkins Bros.....New York.

INSURANCE, MARINE.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Helm, D. T. & Co.....Duluth, Minn.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
La Salle & Co.....Duluth.
Mitchell & Co.....Cleveland.
Osborn, F. H. & Co.....Chicago.
Parker, A. A. & W. B.....Detroit.
Peck, Chas. E. & W. F.....New York and Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

LATHES OF ALL KINDS.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

LAUNCHES—NAPHTHA, ELECTRIC.
Gas Engine & Power Co.....New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.
Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.
Page Bros. & Co.....Boston.
Porter's Sons' Co., Wm.....New York.

LOGS.
Walker & Son, Thomas.....Birmingham, Eng.
Also Ship Chandlers.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.....Philadelphia.

MACHINE TOOLS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.

MALLETS FOR CAULKERS, BOILER MAKERS, ETC.
N. Y. Mallet & Handle Works.....New York.

MARINE RAILWAYS, BUILDERS OF
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Blower Co.....Detroit.
American Ship Building Co.....Cleveland.
Boston Blower Co.....Hyde Park, Mass.
Bloomsburg & Co., H.....Newport News, Va.
Buffalo Forge Co.....Buffalo.
Detroit Shipbuilding Co.....Detroit.
Sturtevant, B. F. Co.....Boston.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
U. S. Metallic Packing Co.....Philadelphia.

METALS FOR BEARINGS.
Cramp, Wm. & Sons.....Philadelphia.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.

METAL POLISH.
Bertram's Oil Polish Co.....Boston, Mass.
Paul & Co., J. C.....Chicago.

MILLING MACHINES OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

NAUTICAL INSTRUMENTS.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
See, Horace.....New York.
Wood, W. J.....Chicago.

OAKUM.
Stratford Oakum Co., Geo.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....Jersey City, N. J.
Standard Oil Co.....Cleveland.

OUTFITTING OF VESSELS—CARPETS, FURNITURE, ETC.
Sterling, Welch & Co.....Cleveland.
Williams & Rodgers Co.....Cleveland.

PACKING.
Crane Co.....Chicago.
Garlock Packing Co.....Palmyra, N. Y.
Jenkins Bros.....New York.
Katzenstein, L. & Co.....New York.
Sayen & Schultz.....Philadelphia.
U. S. Metallic Packing Co.....Philadelphia.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Smith, Edward & Co.....New York.
Upson-Walton Co.....Cleveland.

PATENT ATTORNEYS.
Thurston & Bates.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc.....Philadelphia.

PIPE THREADING AND CUTTING MACHINES.
Merrell Mnfg. Co.....Toledo, O.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland.
Crane Co.....Chicago.

PLANERS OF ALL KINDS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc.....Philadelphia.

PLATE BENDING AND PLANING MACHINES.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood & Co., R. D.....Philadelphia.

PLUMBING, MARINE.
Mott Iron Works, J. L.....New York.
Reilly Repair & Supply Co., James.....New York.
Sands, Alfred B. & Son.....New York.

PNEUMATIC TOOLS.
Standard Pneumatic Tool Co.....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston.
Paul & Co., J. C.....Chicago.

PRESSURE REGULATORS.
D'Este Co., Julian.....Boston.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Hyde Windlass Co.....Bath, Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
MacKinnon Mfg. Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd.....Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.

PROJECTORS, ELECTRIC.
Bullock Electric Mnfg. Co.....Cincinnati.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Kingsford Foundry & Machine Works.....Oswego, N. Y.
Wood, R. D. & Co.....Philadelphia.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
Niles Tool Works Co.....Hamilton, O.
Wood, R. D. & Co.....Philadelphia.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Automatic Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER GOODS.
Hale Rubber Co., Alfred.....So. Boston, Mass.

RUBBER INSULATED WIRES.
Roebling's Sons, John A.....New York and Cleveland.
American Steel & Wire Co.....Chicago.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SEAM COMPOSITION AND ELASTIC SEAM PAINT.
Cole & Kuhls.....Brooklyn.

SEARCH LIGHTS.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Seidler-Miner Electric Co.....Detroit.
Westinghouse Electric & Mnfg. Co.....Pittsburg.

SHAPERS.
Bement, Miles & Co.....Philadelphia.
Niles Tool Works Co.....Hamilton, O.
Pratt & Whitney Co.....Hartford, Conn.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Ship & Engine Co.....Quincy, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Jenks Ship Building Co.....Port Huron, Mich.
Lockwood Mnfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Neafie & Levy Ship & Engine Bldg. Co.....Philadelphia.
Newport News Ship Building Co.....Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Trigg, Wm. R. Co.....Richmond, Va.
Union Iron Works.....San Francisco.
Willard, Chas. P. & Co.....Chicago.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Moran Bros. Co.....Seattle, Wash.
Reilly Repair & Supply Co., James.....New York.
Upson-Walton Co.....Cleveland.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEAMSHIP LINES, PASS. AND FREIGHT.
American Line.....New York.
Cleveland & Buffalo Transit Co.....Cleveland.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL CASTINGS.
Seaboard Steel Casting Co.....Chester, Pa.

STEERING APPARATUS.
American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Electro-Dynamic Co.....Philadelphia.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mnfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.
Wright, Herbert & Co.....Cleveland.

STOCKLESS ANCHORS.
Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.

STRUCTURES OF STEEL, BUILDERS OF.
American Bridge Co.....New York.

SUBMARINE DIVING APPARATUS.
Hale Rubber Co., Alfred.....So. Boston, Mass.

SURVEYORS, MARINE.
See, Horace.....New York.
Wood, W. J.....Chicago.

TELEGRAPH—DECK AND ENGINE ROOM.
Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.
Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburg.

THERMOMETERS FOR MECHANICAL PURPOSES.
Helios-Upton Co.....Peabody, Mass.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
Bement, Miles & Co.....Philadelphia.
Cleveland Punch & Shear Works Co.....Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Pond Machine Tool Co.....Plainfield, N. J.
Pratt & Whitney Co.....Hartford, Conn.
Standard Pneumatic Tool Co.....Chicago.
Watson-Stillman Co.....New York.
Wood, R. D. & Co.....Philadelphia.

TOOLS, WOOD WORKING.
Atlantic Works, Inc.....Philadelphia.

TOPOPHONE—Prevents disasters in fogs.
Colt Co. J. B.....New York.

TOWING MACHINES.
American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.

TOWING COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

TRAPS, STEAM.
D'Este Co., Julian.....Boston.
Haines Co., Wm. S.....Philadelphia.

TRUCKS.
Boston & Lockport Block Co.....Boston.

TUBING, SEAMLESS.
Benedict & Burnham Mnfg. Co.....Waterbury, Conn.
Standard Seamless Tube Co.....Pittsburg.

VALVES, STEAM SPECIALTIES, ETC.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crane Co.....Chicago.
Crosby Steam Gage & Valve Co.....Boston.
D'Este Co., Julian.....Boston.
Jenkins Bros.....New York.

VARNISH MAKERS, COLOR GRINDERS, ETC.
Smith, Edward & Co.....New York.

VARNISH PAINT.
Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Chamberlain & Co., S. R.....Chicago.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Hall & Root.....Buffalo.
Helm, D. T. & Co.....Duluth, Minn.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Kennedy Hunter & Co.....Antwerp.
Mitchell & Co.....Cleveland.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

VENTILATING APPARATUS FOR SHIPS.
American Blower Co.....Detroit.
Boston Blower Co.....Hyde Park, Mass.
Buffalo Forge Co.....Buffalo.
Sturtevant, B. F. Co.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.
American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A.....New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Signal & Control Co.....New York.

WINDLASSES.
American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.
American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Atlantic Works, Inc.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.
Donnelly Salvage & Wrecking Co.....Kingston, Ont.
Midland Towing & Wrecking Co., Ltd.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.
Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.
Willard, Chas. P. & Co.....Chicago.

YAWLS.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

ALPHABETICAL INDEX OF ADVERTISERS IN THE MARINE REVIEW.

The star (*) indicates that the advertisement appears alternate weeks. For addresses see advertisements on pages noted.

Almy Water Tube Boiler Co. 11
American Blower Co. 40
*American Bridge Co. 26
American Line 7
American Ship Building Co. 1
American Ship Windlass Co. 2
American Steam Gauge Co. 1
American Steel & Wire Co. 1
Armstrong Cork Co. 40
Ashton Valve Co. 12
Atlantic Works 5
*Atlantic Works, Inc. 7

Babcock & Wilcox Co. 11
Baldt Anchor Co. 9
Baker, Howard H. & Co. 6
Bath Iron Works, Ltd. 1
Bement, Miles & Co.
Benedict & Burnham Mnfg. Co. 28
Bertram's Oil Polish Co. 1
Bessemer Steamship Co. 8
Big Four Railway 39
Blake, Geo. F., Mnfg. Co. 9
*Bliss, John & Co. 30
*Bloomsburg & Co., H. 31
Boland, J. J. 34
Boston Blower Co. 4
*Boston & Lockport Block Co. 40
*Boyer Water Tube Boiler Co. 31
Bourne-Fuller Co. 12
Brown & Co. 34
Brown Hoisting Machinery Co., Inc. 2
Buffalo Dry Dock Co. 11
Buffalo Forge Co. 12
Bullock Electric Mnfg. Co. 1

Castner, Curran & Bullitt. 33
Chamberlain & Co., S. R. 34
Champion Rivet Co. 8
Chase Machine Co. 8
Chicago Ship Building Co. 2
Clayton Fire Extinguishing & Disinfecting Co. 31
Cleveland & Buffalo Transit Co. 31
Cleveland City Forge & Iron Co. 6
Cleveland Punch & Shear Works Co. 28
C. C. C. & St. L. R. R. 39
Cole & Kuhls. 9
Coleman & Sons, Walter. 40
Colt Co., J. B. 10
Continental Iron Works. 2
Cory, Chas. & Son. 10
*Craig Ship Building Co. 30
Cramp, Wm. & Sons, S. & E. B. Co. 1
Crandall & Son, H. I. 7
Crane Co. 6
Crosby Steam Gage & Valve Co. 12

Dearborn Drug & Chemical Works. 30
D'Este Co., Julian. 3

Delauney, Belleville & Co. 27
Delaware River Iron S. B. & E. Works. 5
Detroit Shipbuilding Co. 1
Detroit Screw Works. 11
Dixon Crucible Co., Joseph. 9
Donnelly Salvage & Wrecking Co. 32
Drake & Maytham. 34
Drein, Thos. & Son. 4
Duluth, South Shore & Atlantic Ry. 39

Electro-Dynamic Co. 1
Elphicke, C. W. & Co. 34
Elwell-Parker Electric Co. 2
Erie & Western Trans. Co. 32

Falls Hollow Staybolt Co. 4
Farrar & Trefts. 5
Fields, J. M. 34
Fletcher, W. & A. Co. 4
Fogg, M. W. 31
Fore River Ship & Engine Co. 5

Garlock Packing Co. 28
Gas Engine & Power Co. and Chas. L. Seabury & Co., Consolidated. 31
General Electric Co. 12
Gilchrist, Albert J. 34
*Gleason-Peters Air Pump Co.
Goerz, G. P. 9
Goulder, Holding & Masten. 34
Graphite Lubricating Co. 9
Great Lakes Register. 7

Haines Co., Wm. S. ..
Hale Rubber Co., Alfred. 9
Hall & Root. 34
Hanna, M. A. & Co. 32
Hardy, John B. 4
Harlan & Hollingsworth Co., The. 5
Helios-Upton Co. 8
Helm, D. T. & Co. 34
Herriman, F. D. 7
Hodge, S. F. & Co. 8
Holmes, Samuel. 34
Holtzer-Cabot Electric Co. 2
Hoyt, Dustin & Kelley. 34
Hunt, Robert W. & Co. 34
Hutchinson & Co. 24
Hyde Windlass Co. 40

International Anchor Co. 9
International Navigation Co. 7

Jenkins Brothers. 10-12
Jenks Ship Building Co. 39

Kahnweiler's Sons, David. 4
Katzenstein, L. & Co. 4
Keith, J. G. & Co. 34
Kennedy Hunter & Co. 3
Kingsford Foundry & Machine Works. 30

Lake Shore Engine Works. 1
Lane & DeGroot. 4
*Learmonth, Robert. 30
Lidgerwood Mfg. Co. 10
Lockwood Mnfg. Co. 4
"Long Arm" System Co. 3
L. S. & M. S. Ry. 39

MacDonald, Ray G. 34
MacKinnon Mfg. Co. 8
Mair, John & Son. 6
*Marine Iron Co. 7
Martin-Barriss Co. 8
Maryland Steel Co. 5
Merrell Mnfg. Co. 5
Midland Towing & Wrecking Co., Ltd. 40
Miller, Walter. 9
Mitchell & Co. 34
Monongahela Iron & Steel Co. 3
*Moran Bros. Co. 39
*Mott Iron Works, J. L. 10
Mulholland, M. 33

Neafie & Levy Co. 5
*Newhall Chain Forge & Iron Co. 30
Newport News Ship Building & Dry Dock Co. 5
New York Mallet & Handle Works. 30
Niles Tool Works Co. 3
Nixon, Lewis. 5
North River Iron Works. 4

Ohio Fuel Co. 32
Olds Motor Works. ..
Osborne & Co., F. H. 34

Page Bros. & Co. 3
Parker, A. A. & B. W. 32
Paul & Co., J. C. 28
Peck, Chas. E. & W. F. 7
Phosphor Bronze Smelting Co., Ltd. 8
Pickands, Mather & Co. 32
Pinney, Orestes C. 34
Pittsburg Coal Co. 33
Pittsburgh Testing Laboratory, Ltd. 34
Pond Machine Tool Co.
Porter's Sons' Co., Wm. 4
Powell, Ambrose V. 34
Pratt & Whitney Co.
Pusey & Jones Co. 5

Queen City Engineering Co. 10

Red Star Line. 7
*Reilly Repair & Supply Co., James. 10
Reynolds, H. J. 9
Richardson, W. C. 34
Risdon Iron Works. 5
*Ritchie & Sons, E. S. 30
Roach's Ship Yard. 5
Roberts Water Tube Boiler Co. 11
Rochester & Pittsburgh Coal & Iron Co. 33
*Roebling's, John A. Sons Co. 40
Rushmore Dynamo Works. 4

Safety Car Heating & Lighting Co. 31
Sands, Alfred B. & Son. 10
Sayen & Schultz. 1
Scherzer Rolling Lift Bridge Co. 6
Scott Co., The W. L. 32
Seaboard Steel Casting Co. 29
See, Horace. 34
Seidler-Miner Electric Co. 8
Sheriffs Mfg. Co. 10
Shipowners Dry Dock Co. 12
*Signal & Control Co. 7
Skinner Chuck Co. 3
Smith, Edward & Co. 1
Smith, Stanley B. & Co. 33
Standard Chain Co. 10
*Standard Oil Co. 3
Standard Releasing Hook Co. 2
*Standard Pneumatic Tool Co. 26
Standard Seamless Tube Co. 29
Sterling, Welch & Co. 32
Stirling Co. 11
Stowe & Graydon. 34
Stratford Oakum Co., Geo. 31
Sturtevant, B. F. Co. 40
Sullivan & Co. 34
Swain Wrecking Co. 32

Thurston & Bates. 34
Trigg Co., Wm. R. 4
Trout, H. G. 9

Union Iron Works. 5
Upson-Walton Co. 40
U. S. Metallic Packing Co. 40

Walker, Thomas & Son. 3
Watson-Stillman Co. 39
Westinghouse Electric & Mnfg. Co. 6
Wheeling & Lake Erie R. R. 39
White, Johnson, McCaslin & Cannon. 34
Willard, Chas. P. & Co. 30
Williams & Rodgers Co. 32
Wilson, Thomas. 34
Wilson & Silsby. 6
Wood, W. J. 34
*Wood & Co., R. D. 30
Worthington, Henry R. 9
Wright, Herbert & Co. 34

Youghiogheny & Lehigh Coal Co. 33

MORAN BROS. COMPANY

SEATTLE, WASHINGTON

SHIP AND ENGINE BUILDERS

STEEL AND WOOD VESSELS, STEAM OR SAIL

FOR OCEAN, SOUND AND RIVER SERVICE

FOUNDRY, MACHINE, BOILER AND FORGE SHOPS

LARGEST TOOLS AND EQUAL TO ANY REQUIREMENT

HEAVY FORGINGS A SPECIALTY

DRY DOCK AND MARINE RAILWAY

Two-Section balanced floating dry dock, 400 ft. long, 60 ft. between towers; patent steel wedge keel blocks; 12,000 tons displacement.

CAPACITY OF MARINE RAILWAY 1500 TONS

SHIP CHANDLERY, ENGINEERS' SUPPLIES

SAW AND PLANING MILL

CAPACITY: TIMBER, 48 INCHES SQUARE, 125 FEET LONG

Including every description of ROUGH, DRESSED or KILN DRIED

YELLOW FIR, RED CEDAR OR SPRUCE

We make a specialty of long and large timber and can DRESS FOUR SIDES 20 x 30 INCHES.

SPARS THE LONGEST, LARGEST, CLEAREST AND BEST IN THE WORLD; ROUGH OR HEWN.

PILES OR TIMBER OF ANY DESCRIPTION.

CARS FROM ALL TRANSCONTINENTAL ROADS ENTER OUR YARDS AND DOCKS

DOCK SHIPMENTS TO ALL PARTS OF THE WORLD

ELECTRIC CRANE Capacity to transfer 75 tons from car to vessel

WE INVITE CORRESPONDENCE

LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

CLEVELAND CITY TICKET OFFICE 237 SUPERIOR ST

Eastward:—	Ar. fr. West.	Dep. East.
No. 18, Southwestern Limited	.....	*1 55 am
No. 22, Lake Shore Limited	*2 15 am	*2 20 am
No. 28, New York & Boston Express	*7 40 am	*8 00 am
No. 32, Fast Mail	*11 25 am	*11 30 am
No. 44, Accommodation, via Sandusky	†1 35 pm	.....
No. 46, Southwestern Express	.....	*3 00 pm
No. 6, Limited Fast Mail	*5 40 pm	*5 45 pm
No. 10, Chicago, New York & Boston Special....	*7 35 pm	*7 40 pm
No. 61, New England Express	*10 30 pm	*10 35 pm
No. 2, Day Express	†9 05 pm	†9 20 pm
No. 126, Norwalk Accommodation	†7 55 am	.....
No. 40, Toledo & Buffalo Accom., via Norwalk..	†10 00 am	†10 30 am
No. 106, Conneaut Accommodation	.....	†4 30 pm
Westward:—	**Ar. fr. East.**	**Dep. West.**
No. 11, Southwestern Limited	*3 25 am	.....
No. 15, New York, Boston & Chicago Special....	*3 05 am	*3 10 am
No. 21, New York & Chicago Express.....	*5 10 am	*5 20 am
No. 7, Day Express	.....	†6 30 am
No. 19, The Lake Shore Limited	*7 35 am	*7 40 am
No. 23, Western Express	*11 10 am	*11 15 am
No. 33, Southwestern Express	*12 25 pm	.....
No. 133, Cleveland & Detroit Express	.....	*12 30 pm
No. 47, Accommodation	.....	†3 00 pm
No. 141, Sandusky Accommodation	.....	†3 10 pm
No. 127, Norwalk Accommodation	.....	†5 10 pm
No. 37, Pacific Express	*7 00 pm	*7 20 pm
No. 5, Fast Mail Limited	*10 50 pm	*10 55 pm
No. 115, Conneaut Accommodation	†8 30 am	.....

*Daily. †Daily except Sunday. Trains Nos. 28 and 37 run via Erie station.

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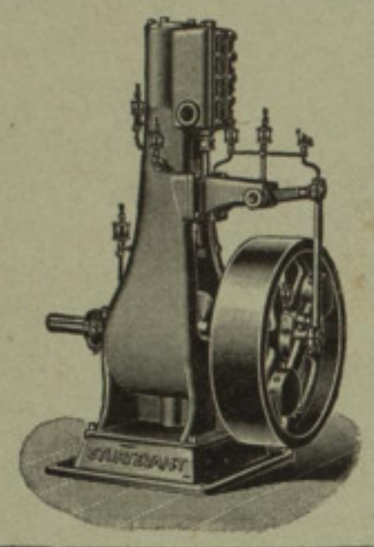

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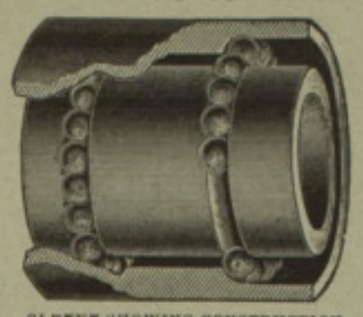

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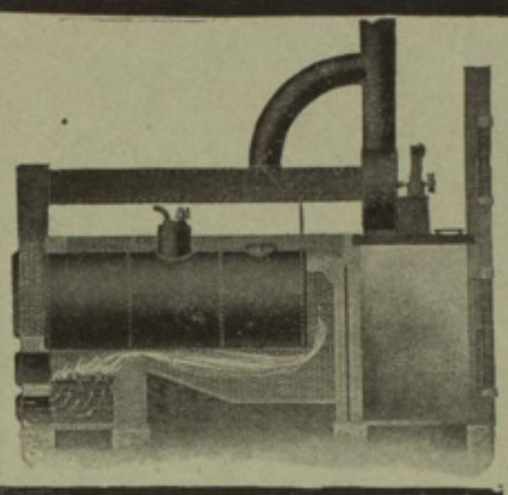

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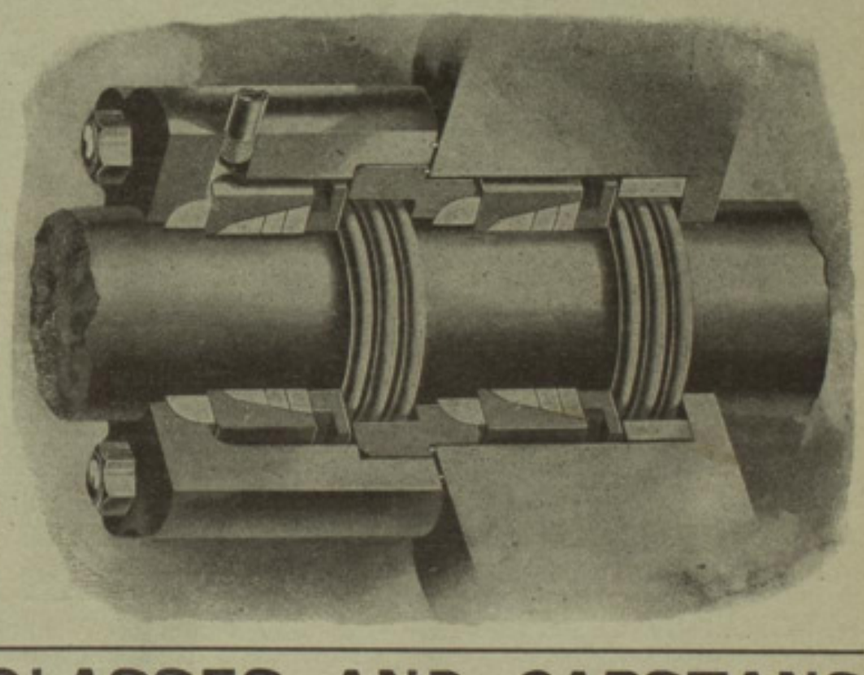

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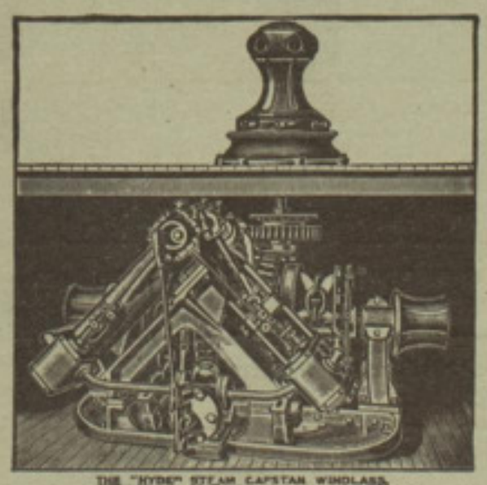

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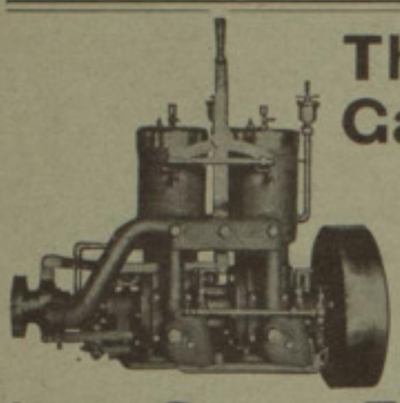

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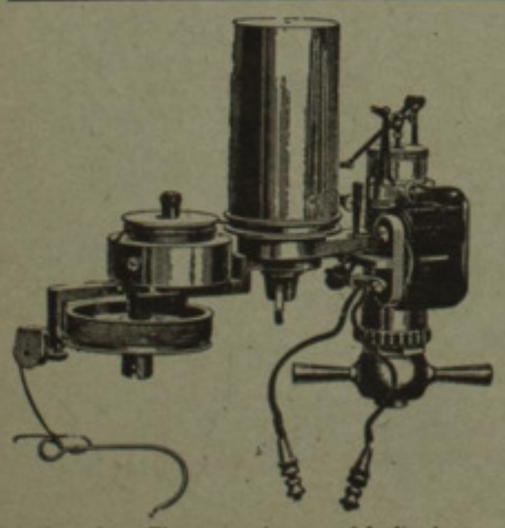

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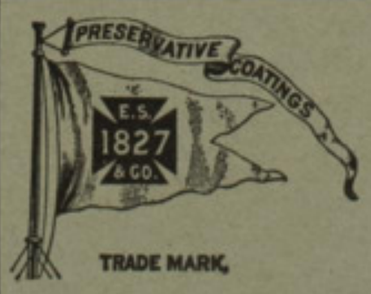

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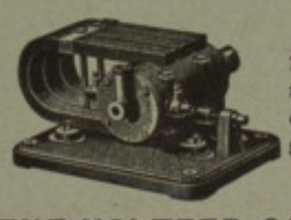

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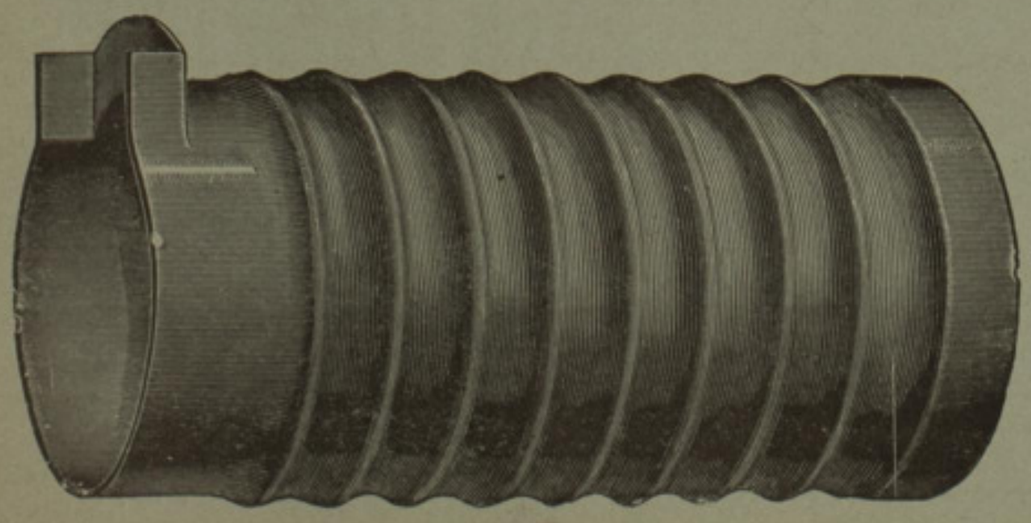

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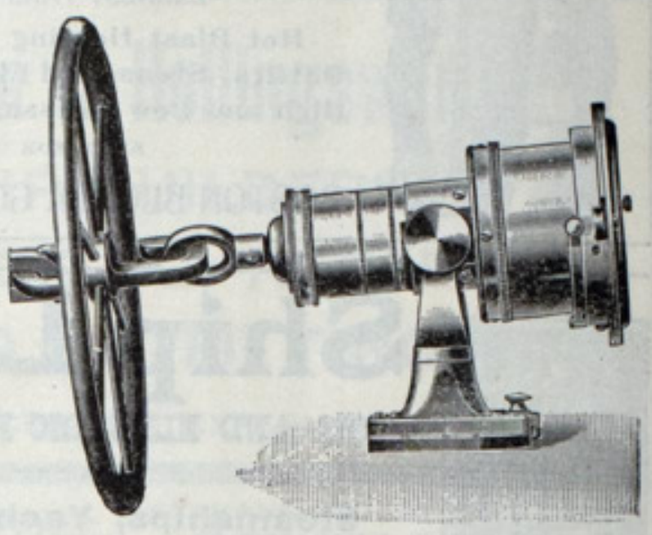

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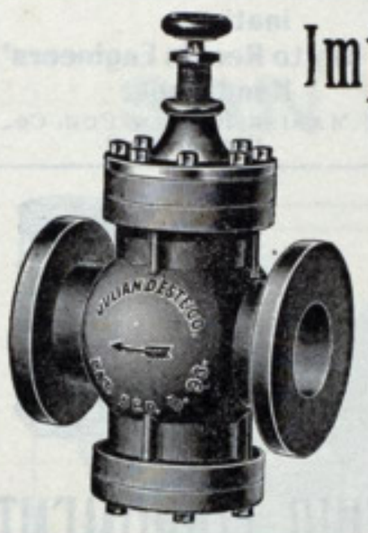

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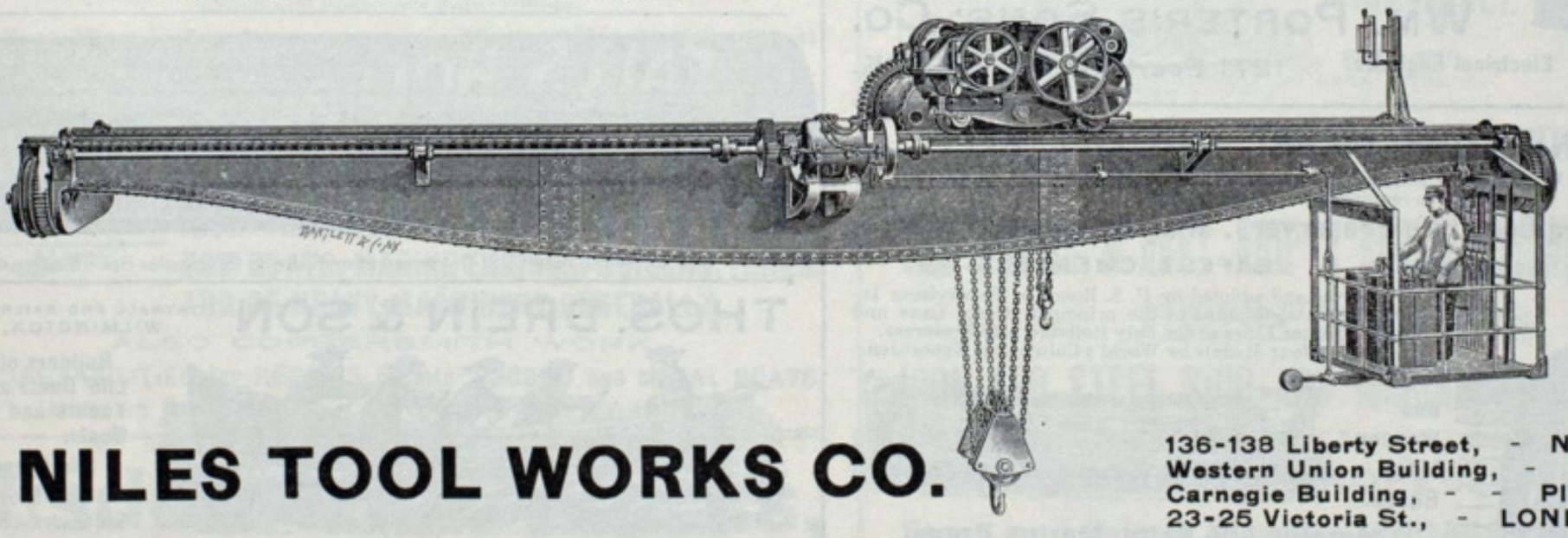

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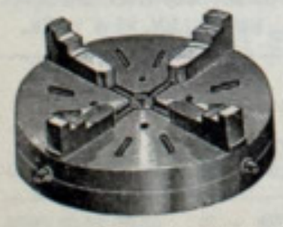

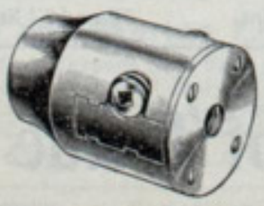

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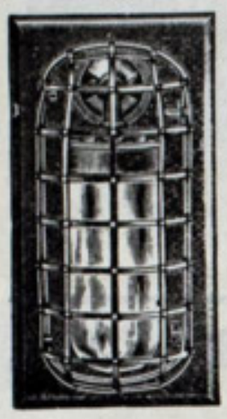

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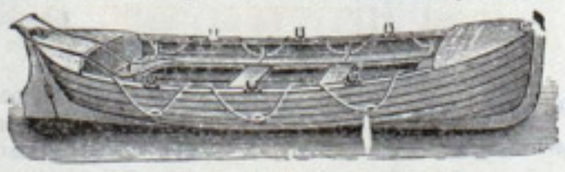

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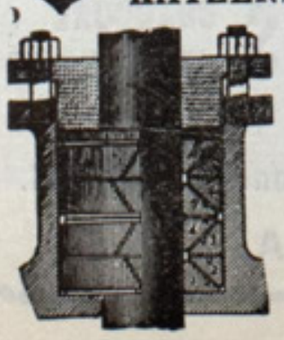

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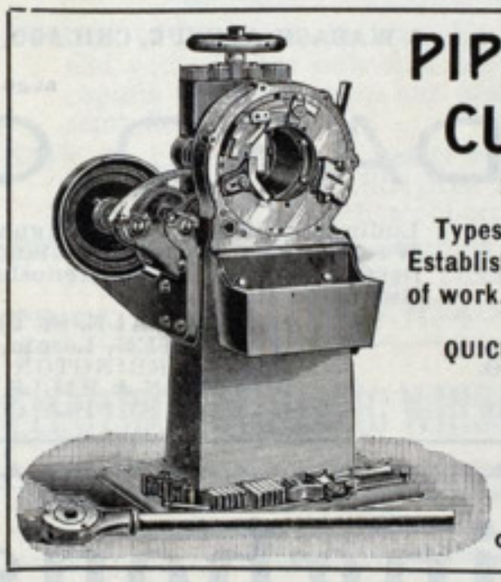

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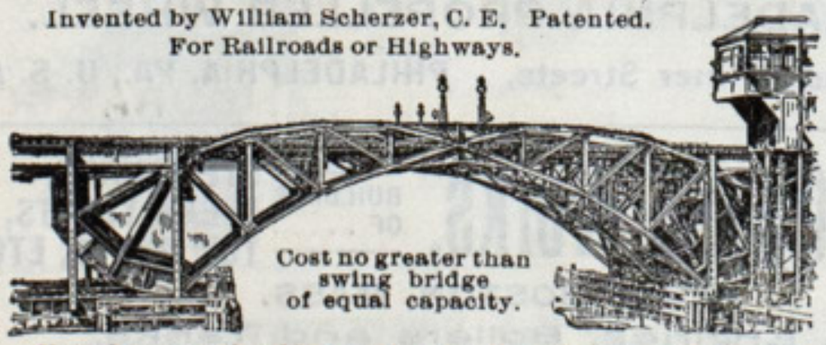

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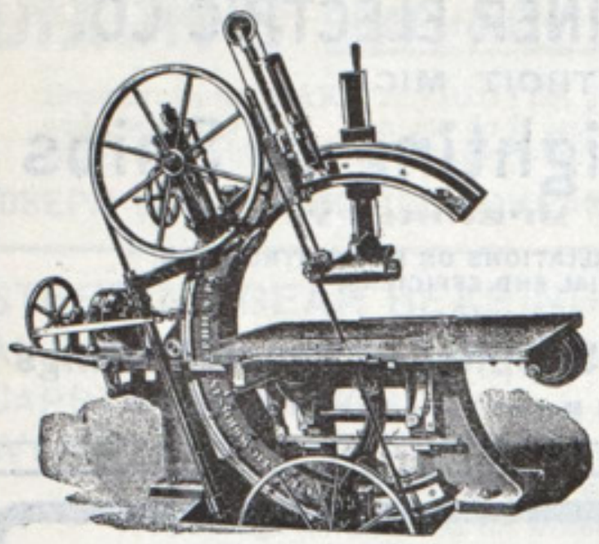

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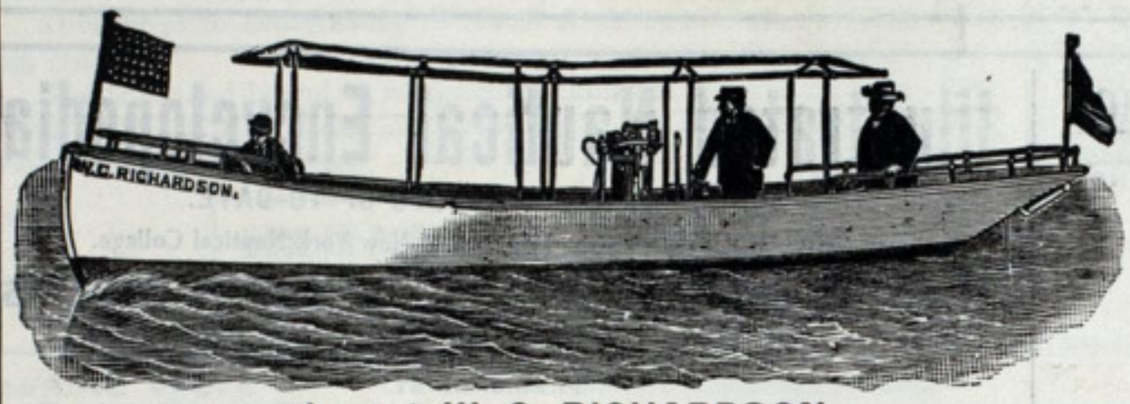

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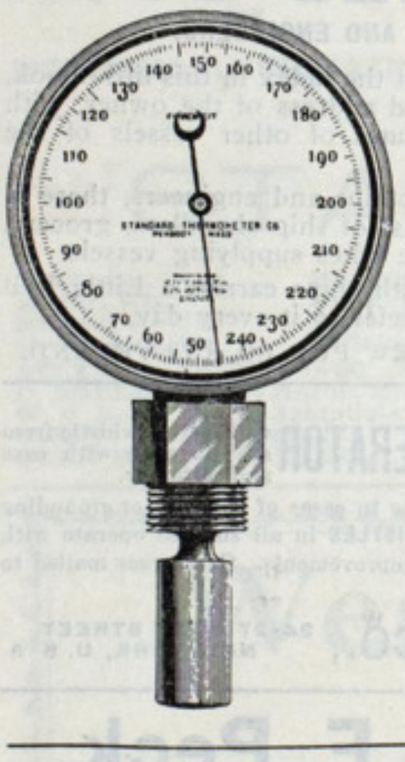

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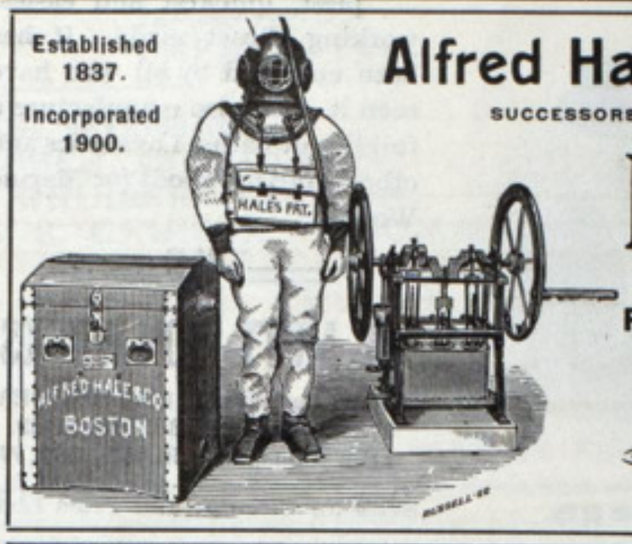

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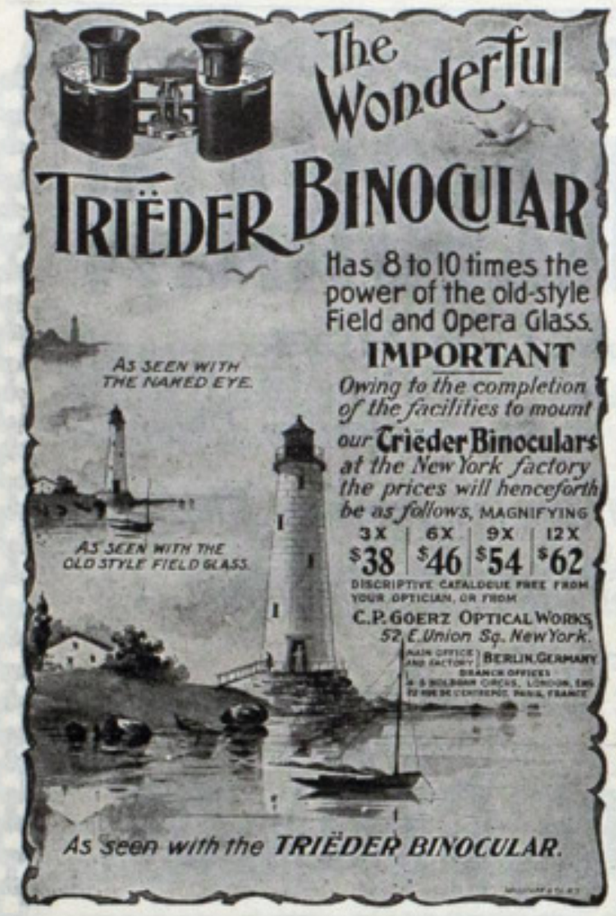

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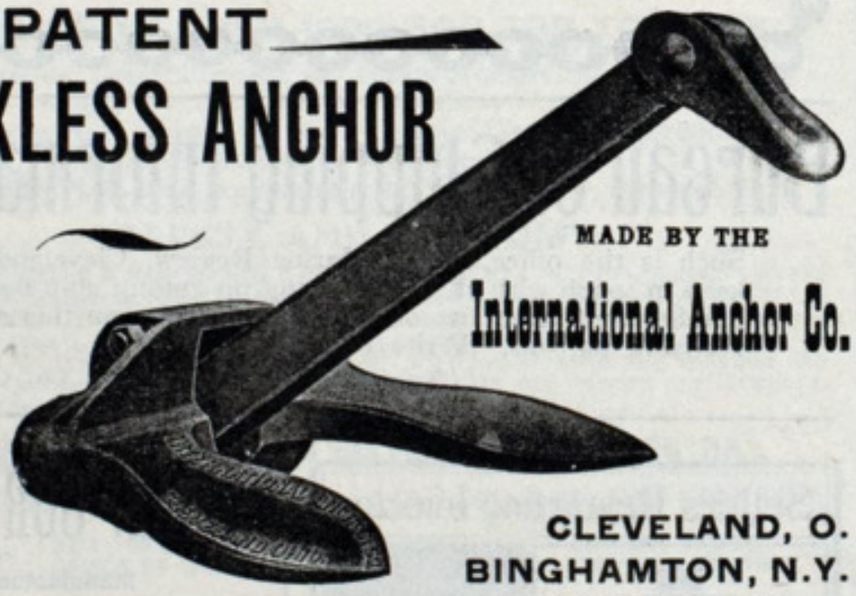

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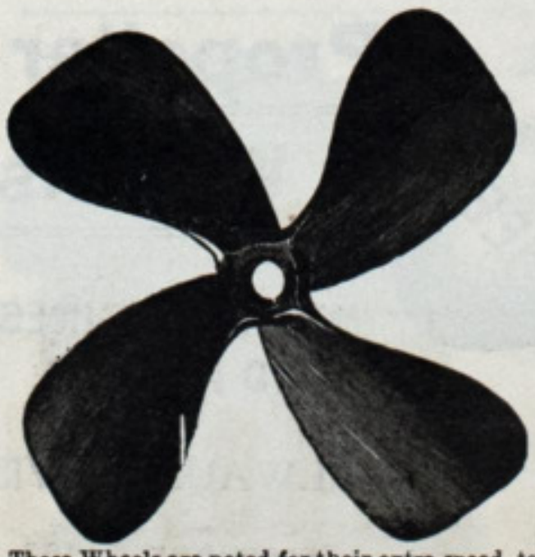

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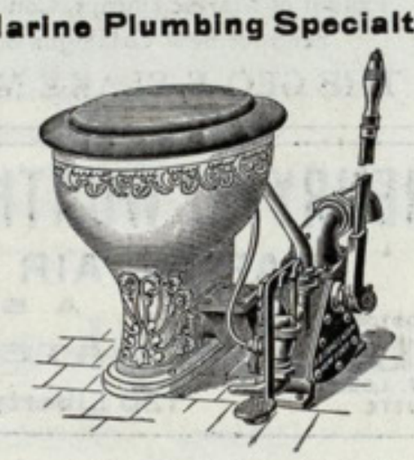

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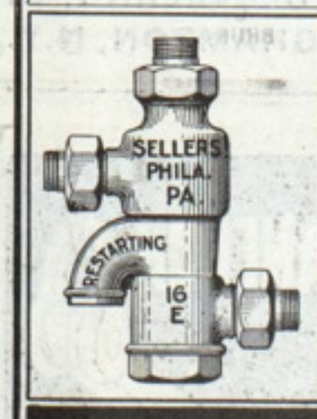

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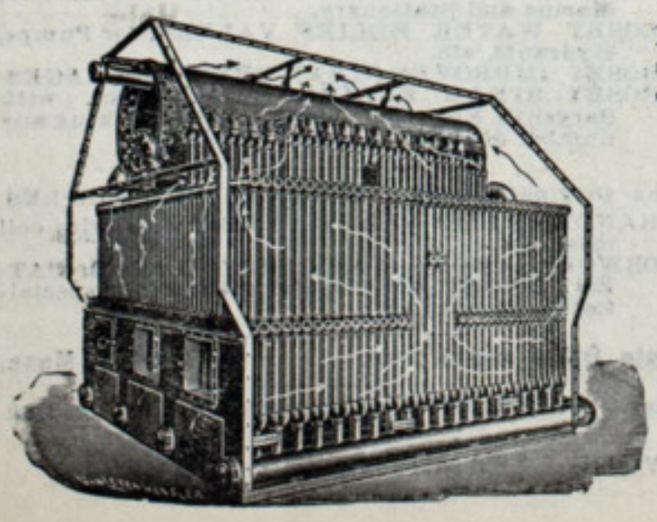

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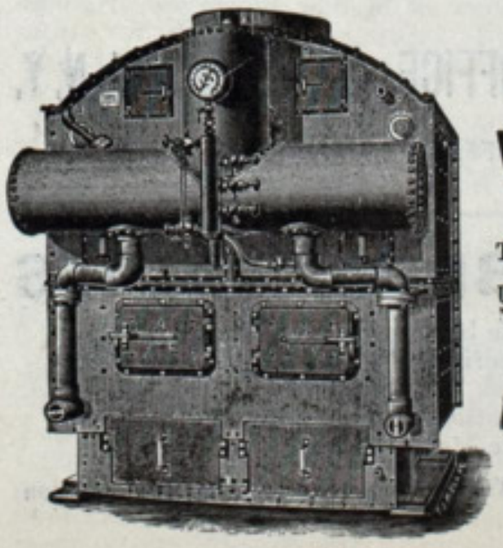

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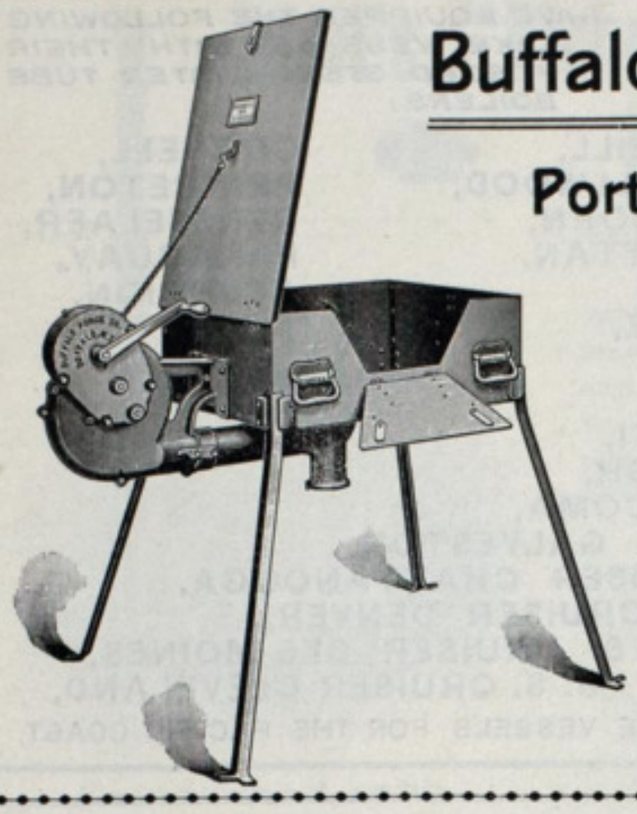

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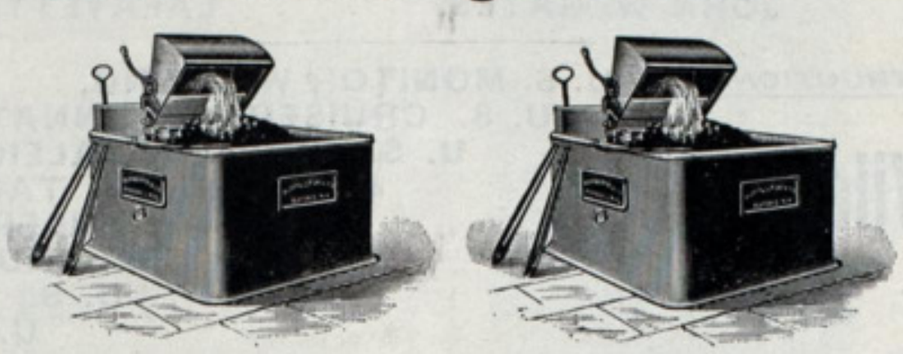

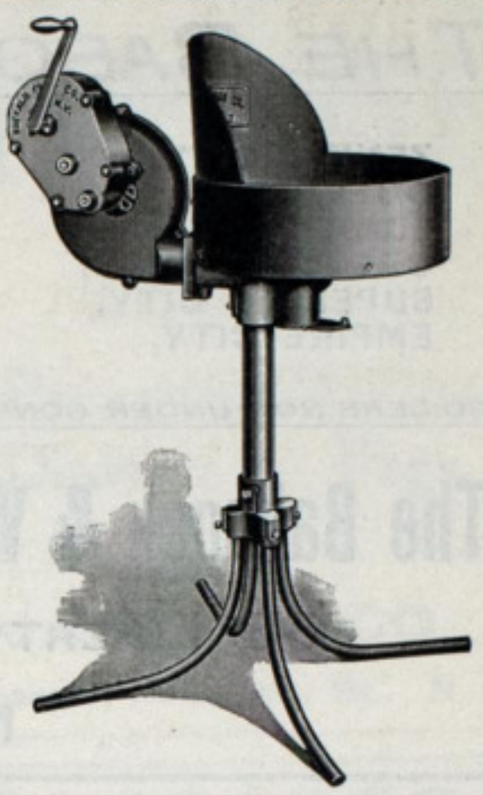

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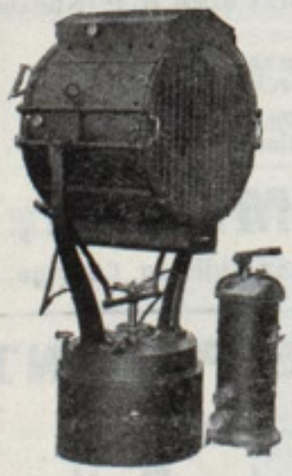

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